RAILROAD GAZETTE

FRIDAY, JULY 25, 1902.

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Contributions

Rolling Lift and Trunnion Bascule Bridges.

The Scherzer Rolling Lift Bridge Co.,
Chicago, July 1[illegible] 1902.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The *Railroad Gazette* of the 11th inst[illegible]30. contained an illustration showing a general plan of the Clybourn Place trunnion bascule bridge, Chicago. In the article on the same page referring to this bridge it is reported, after mentioning the fact that the plans of the bridge were prepared by the engineering de[illegible]ment of the City of Chicago, that "before preparing the design a committee appointed to submit plans made a careful study of the information on movable bridges of the United States and Europe, and decided on the trunnion bascule type as more fully meeting the requirements from a scientific, economical and practical standpoint than any other available type."

This untrue and sweeping statement is injurious to our business interests because of the wide circulation and high standing of the *Railroad Gazette*, both at home and abroad, and we hope that you will give equal publicity to the following statement of facts:

The only committee in connection with the Clybourn Place bridge that we know of was one which, we are informed, was composed of Messrs. E. L. Cooley (brother of Lyman Cooley), Ralph Modjeska and Byron B. Carter. From a report of the action of this committee as contained in the *Engineering Record* of July 2, 1900, it appears that this committee was appointed by an official of the present Chicago city administration to pass only upon the plans prepared by its appointed city engineer, Mr. John Ericson, and that these plans consisted of three designs of trunnion bascule bridges prepared under his charge.

This report does not mention any other type of bascule bridge than the trunnion bascule bridge, and we believe that this committee did not pass upon the comparative "scientific, economical and practical" values of other types of bascule bridges. We did not receive notice of the appointment or meetings of this committee, nor were we ever invited to attend or be represented at any of its meetings.

If, however, a committee claims, as reported in the article in the *Railroad Gazette*, that it has made a careful study of the information on movable bridges in the United States and Europe and decided on the trunnion bascule type as "more fully meeting the requirements from a scientific, economical and practical standpoint than any other available type," then such committee has ignored many prominent successful existing movable bridges, well-known facts and public records easily accessible. The ability of such a committee to hold a position of trust and render a final decision settling a subject of such great importance to all governments, municipalities and railroad companies must be questioned.

The Scherzer rolling lift or bascule bridge was invented, patented and used nearly 10 years ago because the trunnion type of bascule bridge was inadequate to meet the requirements of the Metropolitan Elevated Railroad of Chicago. The Scherzer rolling lift bridge is more modern, scientific, economical and practical than the trunnion bascule bridge.

1. The trunnion bascule bridge is not the most scientific movable bridge. The reasons are so numerous that we can mention only a few of them.

A. Fundamentally the great sliding friction of the trunnions of the trunnion bascule bridge is unscientific as compared with the virtual absence of friction of the large rollers of the Scherzer rolling lift or bascule bridge. This is especially valuable in a movable bridge because of the large masses or weight to be supported and rapidly moved.

B. The trunnion bascule bridge does not move back from the waterway when it is opened. It, therefore, requires a longer span than the Scherzer rolling lift bridge in order to provide an equal width of clear channel for navigation. The Scherzer rolling lift bridge provides the maximum width of clear channel for navigation with the shortest possible span because the Scherzer rolling lift bridge moves back and away from the channel when it is opened.

This advantage of the Scherzer rolling lift bridge has a large, economical and practical as well as scientific value over the trunnion bascule bridge. Every foot saved by a reduction of span of a movable bridge means a large saving in structural steel, counterweight, machinery, operating equipment and substructure, and consequently in the cost of the bridge.

Because the Clybourn Place bridge is a trunnion bascule bridge it requires a movable span 18 ft. longer than a Scherzer rolling lift bridge, giving the same width of clear channel. This advantage of the Scherzer rolling lift bridge alone would save more than $25,000 on the cost of the Clybourn Place trunnion bridge.

C. The Clybourn Place trunnion bridge is a through bridge and has large, deep and very expensive counterweight pits in the substructure. A through Scherzer rolling lift bridge would not require any counterweight pits whatever, and the substructure is comparatively small, as shown by the design of the much larger Scherzer rolling lift bridge under construction at the mouth of Newtown Creek, New York City, illustrated and described in the *Railroad Gazette* of Nov. 29, 1901, on page 822, and by a large number of other through Scherzer rolling lift bridges.

D. In the description of the Clybourn Place trunnion bridge attention is called to a very small by-pass under each tail pit designed to provide additional waterflow. Scherzer rolling lift bridges whenever desired have been and are built to provide a very much larger waterflow, as has been done in many cases, and is illustrated in the design for the Newtown Creek bridge without the special and expensive construction for by-passes used at the Clybourn Place trunnion bridge.

2. All Scherzer rolling lift bridges have been and are constructed more economically than the Clybourn Place trunnion bridge. We mention only a few which were contracted for in the same city, under the same market conditions, over the same river, with the same bridge company as contractor for construction as the Clybourn Place trunnion bridge.

A. The Scherzer rolling lift bridge across the Chicago River at Main street gives the same width of roadway and sidewalks as the Clybourn Place trunnion bridge, but it provides a clear channel for navigation 140 ft. wide, while the Clybourn Place trunnion bridge provides a clear channel for navigation only 100 ft. wide, a very material difference in a movable bridge.

Yet the bids received for the construction of this much larger Scherzer rolling lift bridge amounted to $120,388, while the bids received under the same market conditions for the construction of the Clybourn Place bridge amounted to $147,486.

B. Had the clear waterway provided by the Clybourn Place trunnion bridge been as wide as that provided by the Scherzer rolling lift bridge at Main street, namely, 140 ft. wide instead of 100 ft. wide, the proportionate additional cost would have been at least $100,000 more, making the cost of the trunnion bridge for a 140 ft. channel at least $250,000.

C. Had the Main street Scherzer rolling lift bridge been a through bridge similar to the Clybourn Place bridge instead of an arched deck bridge, which design was demanded by the Municipal Art League of Chicago, for artistic reasons, then there would have been a saving on the Main street bridge of at least $17,000, making the total cost of a through Scherzer rolling lift bridge providing a clear channel of 140 ft., giving the same width of roadway and sidewalks as the Clybourn Place bridge, $103,000, which would show a saving in cost of construction of $147,000 in favor of the Scherzer rolling lift bridge.

D. The State street bridge, the most important highway bridge at Chicago, is being built under the plans of The Scherzer Rolling Lift Bridge Company. This is also an arched deck structure, this form being also selected for artistic reasons. It has wider roadways and sidewalks than the Clybourn Place bridge, and it also provides a clear channel for navigation 140 ft. wide in place of only 100 ft. provided by the Clybourn Place trunnion bridge. The masonry of the substructure extends 7 ft. deeper than the masonry of the Clybourn Place trunnion bridge to provide for a 30-ft. depth of water, while the Clybourn Place bridge provides only for a 21-ft. depth of water. Yet this much larger, more important and prominent Scherzer rolling lift bridge costs less than the Clybourn Place trunnion bridge.

E. Highway Scherzer rolling lift bridges constructed, under construction and contracted for in Chicago at North Halsted street, Taylor street, Canal street, Eighteenth street, Polk street and Harrison street, in addition to the railroad bridges at Chicago used by the Metropolitan Elevated Railroad, Chicago Terminal Transfer Railroad, Baltimore & Ohio Railroad, Chicago & Great Western Railroad, Pittsburgh, Cincinnati, Chicago & St. Louis Railroad, and the Chicago Junction Railroad, and numerous other railroad and highway bridges elsewhere further substantiate the very great economy, practicability and scientific value of the Scherzer rolling lift bridges over the trunnion type of bascule bridge.

F. As a further proof that the Scherzer rolling lift bridge is more scientific, economical and practical than the trunnion bascule bridge we offer to furnish two Scherzer rolling lift bridges of the size and capacity of the Clybourn Place trunnion bascule bridge for the cost of that one bridge, or one Scherzer rolling lift bridge for one-half of the cost of the Clybourn Place trunnion bascule bridge, and will guarantee that any of these Scherzer rolling lift bridges will operate more rapidly and with less power than the Clybourn Place trunnion bridge. We will furnish, simultaneously with the receipt of the order and the signing of the contract by a responsible party, an amount of money in cash or bonds equal to the cost of the Scherzer rolling lift bridges ordered, to be held as a guarantee for the faithful fulfillment of our contract. We will be glad to receive any number of orders on this basis at any time within the next two years.

G. More Scherzer rolling lift bridges have already been built than all other types of bascule bridges combined. If simplicity of construction, economy of material and cost of construction, economy of operation, economy of maintenance, certainty of successful and rapid operation, and maximum attainable waterway and waterflow control the selection of the type of movable bridge, then the Scherzer rolling lift bridge merits the success which it has already attained, and, we believe, will not be superseded in the immediate future where merit controls.

Two additional trunnion bascule bridges, according to the plans of the city engineer of Chicago, similar to the Clybourn Place trunnion bridge but even more costly, have been under construction for several years by the city administration.

At least one-half of the money being expended for the construction of trunnion bascule bridges could be saved to the City of Chicago if Scherzer rolling lift bridges were used by the present city administration, as has been done by former city administrations, and as has been done and is being done by the Sanitary District of Chicago at the most important streets crossing the Chicago River.

THE SCHERZER ROLLING LIFT BRIDGE CO.,
By ALBERT H. SCHERZER, *President.*

What is Bird's-Eye Maple?

New York, July 8.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The question has lately been asked, "What is bird's-eye maple?"

Any one who has been in the woods of the Mississippi valley will have noticed that the trees grow to a considerable height before branching. I have seen maples, and made sugar from their sap, on which the lowest branches were not less than 50 ft. from the ground.

When the surrounding trees have been cut away, giving free access of light to the trunks of the maples the trees will send out great numbers of small branches that give the tree the appearance of being wrapped in a dense brushwood with a tuft of the original branches at the top. I do not know of any other species of forest tree that acts in the same way when a clearing is made around it.

It is well known that knots in lumber show the positions of branches. The birds' eyes are small knots surrounded by the usual curl in the grain and produced no doubt by the numberless small branches that are sent out after the tree has stood comparatively alone for some time.

Curly maple may arise from a very different cause, as in the case of curliness in any other kind of wood; but it is entirely consistent that the bird's-eye maple should be curly in places where the eyes are absent.

CHARLES J. BATES.

[Mr. Bates' guess that the beautiful variant known as "bird's-eye" in the grain of some maples is a knot is not a new one. He has been supported, momentarily, by a very large number of people who have for the first time glanced at it without examining it closely. The essential element of a knot is a branch passing through the outer rings of growth, and this is not present in the bird's-eye. Expert timber men cannot surely identify a bird's-eye maple trunk by a study of the bark. It may occur in a straight shaft, with no branches or indications of branches which once existed. The only sure test is to cut it. This whole subject of variants in the form and direction of the grain and of colorings of fine woods is an exceedingly interesting one, but no one that we know of has been able to assign the causes or to surely diagnose the tree or the log without cutting it. It would be a highly valuable knowledge. Many years ago the lumber buyer for the Pullman Company was offered for $3,000 a mahogany log. It was supposed from the surface indications to be "plum pudding" mahogany, but this could not be surely determined before passing it through the veneering cutter. The buyer referred the matter to the late George M. Pullman, who had an ex-

pert knowledge of fine lumber. He declined the offer, but agreed to take the log, cut it into veneering and pay what it proved to be worth. It proved to be worth $7,000, and this sum was paid for it. Any one who can determine the causes and identify these variants in standing timber has a certainty of profitable and enjoyable employment.—Editor.]

The Bridgeport Improvement on the New York, New Haven & Hartford.

The Bridgeport viaduct, now in course of construction for the new high-level line of the New York, New Haven & Hartford Railroad, eliminating some 25 grade-crossings, bettering the alignment and grades of the road and including a large new station, is a notable example of good engineering design, carried out under somewhat difficult conditions, with thorough attention to detail and by the use of sufficient means to accomplish the desired end, even though the necessary cost run into the millions. There are, however, no frills; simply good construction, using, with true economy, the best materials and workmanship for the purpose, as befits the permanent nature of the work.

The city of Bridgeport, with its 70,000 inhabitants, is one of the busiest Connecticut hives of industry, its business center lying along the estuary known as Pequonnock River, nearly parallel to which, running north and south, is the principal business street of the town—Main street. The New York, New Haven & Hartford Railroad approaches Bridgeport from the west by a tangent running nearly due east. Just before reaching the river it turns abruptly at the Main street crossing by a sharp

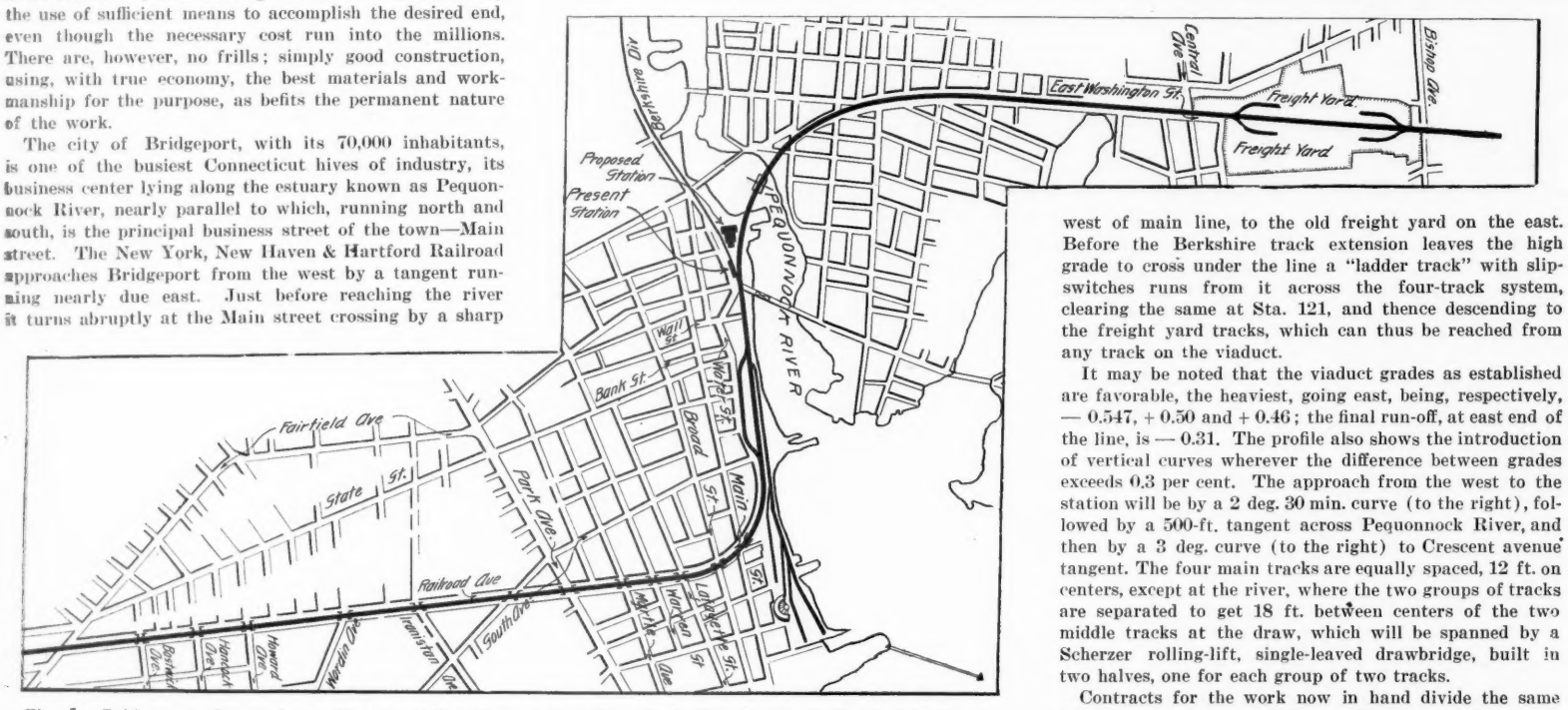


Fig. 1.—Bridgeport, Connecticut; Sketch of the Line of the New York, New Haven & Hartford Railroad.

curve of nearly 90 deg. of arc up the west bank of the river, between it and Water street to the station; thence by a 4-deg. curve the line crosses the river over a primitive type of swing drawbridge and strikes another tangent, also running about due east, with East Washington avenue contiguous to it on the north and Crescent avenue on the south. The offset between the two parallel tangents is about one mile. The Berkshire Division (formerly the Housatonic Railroad), also on the west bank of the Pequonnock River, comes in above the present station, where its tracks are dead-ended. Around the "railroad center" thus, doubtless, inherited from earlier independent roads the business center of the city has clustered and it was, therefore, not deemed wise to radically change the existing main line location, although the connecting curves of the offset are materially lightened and ample space is saved for the proposed new station by making the new line cross the river some 250 ft. southeast of the present bridge. A bad reversed kink in the present main line, half a mile south of the station will also be straightened by sacrificing a part of the freight yard, which is to be extended, while a new yard of 15 tracks (opened March 30) has been provided on the east side of the city between Central and Bishop avenues.

In order to provide for handling the traffic at points where the new construction strikes the existing line, the present double track, starting from the Main street curve, is thrown over to the westward, carried part of the way on a temporary embankment, supported by a substantial grillage of old ties and then (along Water street) by a temporary trestle over portions of the new pier foundations already built. This change having been made, the remaining portions of the piers will be finished to the new high level, so that, by opening to travel two or three of the new tracks, the temporary line can be abandoned and Water street trestle, in front of the present station, and on the east side of the river, it has been found practicable to shift over the present tracks far enough to entirely clear the line of the new structures. These temporary changes are now finished. (the improvement was begun two years ago and the western portion, from the extreme left of the sketch, Fig. 1, to Main street, was finished one year ago, as described in the *Railroad Gazette* of March 1, 1901); but a year must elapse before the new line east of Main street can be opened and the present tracks and station removed, so as to afford a clear site for the proposed new station, which will be located just north and a little to the east of the present building, occupying a space of about 120 x 180 ft., or half an acre. An open square will be left where the old station now stands, thus widening Water street east of Fairfield avenue. The new station will face south on the square, from which a broad flight of steps will lead to the second floor of the station at the new track level. The north front of the proposed station will be approached by a driveway on about a 3 or 4 per cent. grade to a spacious plateau or concourse, where carriages can turn and stand. The final details of the station building are not yet fully matured, but its cost will be not far from $175,000. The structure will be of brick and stone, with a tower and other architectural features, and will present a very handsome and imposing appearance; it will be provided with every convenience for passengers, including subway crossings to reach the different track platforms.

Returning to the viaduct improvement, the western finished portion was described in the *Railroad Gazette*, as just mentioned. On the map, Fig. 1, the streets which were bridged on this part of the line are indicated by marks which show the position of the abutments. This portion of the line lies in the middle of a straight street, as shown, the longitudinal retaining walls being 66 ft. apart, outside to outside, and beginning near Main street crossing, the solid fill with retaining walls is continued to Sta. 121 (stations are 100 ft. apart), where the open viaduct begins, consisting of heavy steel plate-girders carried on masonry piers, every fourth pier coming to the girder-grade and the intermediate low piers supporting built steel columns, spaced 6 ft. on centers and about 9 ft. high, for the floor system between the high-grade piers. This construction extends to the river (Sta. 142). Crossing the river (Sta. 142 to 148) all piers, of course, are built up to the high level and on the east side (Sta. 148 to 154) the open viaduct again continues until it reaches the solid embankment, with its heavy retaining walls, as before, crossing several streets with a minimum head room of 12 ft., and ending near Central avenue (Sta. 204). Thus the entire viaduct improvement covers 185 stations, or a distance of 3½ miles of four-track main line. Additional tracks are also provided as follows, working backward from Sta. 204: On Crescent avenue, east of the river, at about half way of the embankment, the high retaining wall jogs inward and a "ramp track" for freight starts from a level with the street, gradually rising (supported by an outside retaining wall) to the high grade and then extending as a fifth track to the East freight yard. This siding will serve several large manufacturing concerns situated in the vicinity of its starting point. At the station a track on each side of the four main tracks will extend eastward to the river, where each will switch into its nearest main-line track. These extra tracks will be used by the Naugatuck Division, the trains therefrom arriving on the west track (nearest to the station) and leaving from the east track, access to which will be had by passageways carried under the main-line platforms. The Berkshire Division, single track, which is also to be brought in over a pier-supported viaduct, will connect with the west Naugatuck (receiving) track just south of the station, and will then continue as a "ramp track" by a descending grade to an oblique undercrossing (18 ft. clearance), there uniting with tracks leading through it (under main line) from the present freight house on Water street, west of main line, to the old freight yard on the east. Before the Berkshire track extension leaves the high grade to cross under the line a "ladder track" with slip-switches runs from it across the four-track system, clearing the same at Sta. 121, and thence descending to the freight yard tracks, which can thus be reached from any track on the viaduct.

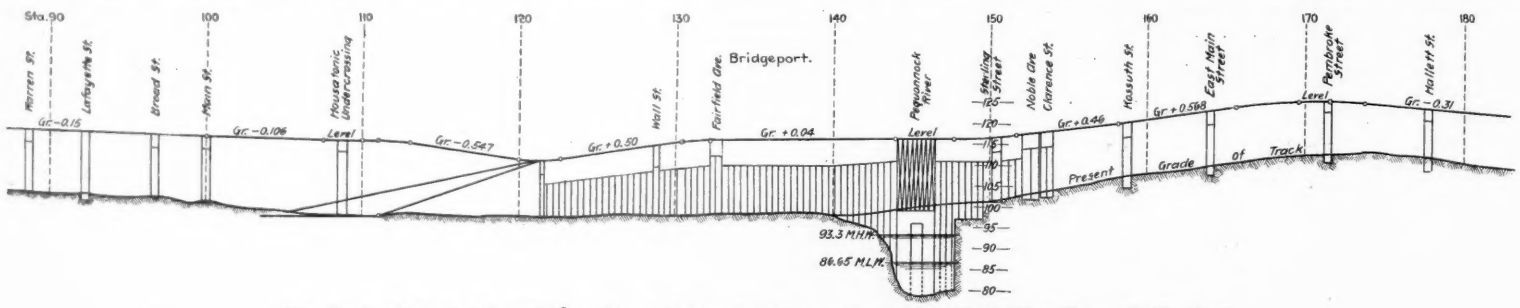


Fig. 2.—Profiles of Old and New Lines—Bridgeport Improvement, New York, New Haven & Hartford.

It may be noted that the viaduct grades as established are favorable, the heaviest, going east, being, respectively, — 0.547, + 0.50 and + 0.46; the final run-off, at east end of the line, is — 0.31. The profile also shows the introduction of vertical curves wherever the difference between grades exceeds 0.3 per cent. The approach from the west to the station will be by a 2 deg. 30 min. curve (to the right), followed by a 500-ft. tangent across Pequonnock River, and then by a 3 deg. curve (to the right) to Crescent avenue tangent. The four main tracks are equally spaced, 12 ft. on centers, except at the river, where the two groups of tracks are separated to get 18 ft. between centers of the two middle tracks at the draw, which will be spanned by a Scherzer rolling-lift, single-leaved drawbridge, built in two halves, one for each group of two tracks.

Contracts for the work now in hand divide the same into three sections, as follows: The first section, from Main street to the river (Sta. 100 to 142), let to Dwight & Daly; the second section, including river work and as far as Noble avenue on the east side (Sta. 142 to 152), awarded to J. J. O'Brien & Co., and the third section, from Noble avenue to Central avenue (Sta. 152 to 204), to John C. Sheehan & Co. These contracts do not include steel structure, of which only the drawbridge is now under contract, awarded to the Pennsylvania Steel Co. All the work is performed under the general specifications of the railroad company, with such local modifications as are necessary, and is in charge of Mr. R. M. Berrian, Assistant Engineer of Construction, to whom many features of the design are due, under approval of C. M. Ingersoll, Jr., Chief Engineer.

The embankment retaining walls, of third-class masonry, about 4 ft. thick, 3 ft. under the coping, are laid with vertical face and the back battered 4 in. to the foot. The coping, 16 x 30 in., and faces of bridge abutments are of second-class masonry, and bridge seats and parapets of first-class, fine pointed. The stone used is a good quality of granite, obtained from Mine Hill and Millstone quarries, Connecticut; Dummerston, Vermont, and Monson and Linwood, Massachusetts. Street openings are crossed by plate girders, or by deck or half-through bridges, according to head room requirements.

The piers for the steel viaduct are spaced 44 ft. 6 in. on centers, west of the river (Sta. 121 to 142) and 46 ft. east of the river (Sta. 148 to 154). The river piers vary from 55 to 59 ft. on centers and on the east side, where several streets are crossed obliquely, skew-piers are built on sidewalk curb line, and, in some cases, in center of street. All the piers are built of first-class granite masonry and of different lengths, according to the number of tracks carried, the longest being 60 ft.; their uniform width is 5 ft. 6 in. on coping (2 ft. thick), and 4 ft. 6 in. under coping, for land piers, and 6 ft. on coping and 5 ft. under coping for river piers. Faces of piers have a uniform batter of 1 in. to the ft. The foundations for piers consist of spruce piles, set about 2 ft.

on centers and driven to hard bottom. The pile-heads under land piers have a filling of concrete around them above the piles; from that level the concrete base starts, with a 3 ft. footing block and 12 in. offset, and then on a batter of 4 in. to the foot to the ground surface, where the granite courses begin, with 12 in. offset. Sheet piling, tongued and grooved (three-ply plank) is driven around land pier foundations, notwithstanding which much costly pumping was required along the Water street front, and a further difficulty was here met with, the made ground along this section having been formerly filled in over mud of a very liquid character. For about 1,000 ft. it was, therefore, necessary to drive a bulkhead of sheet piling, 27 ft. deep, to retain the earth and prevent the mud from flowing, the sheeting being reinforced by two lines of 9 x 16 in. walings, braced by inclined piling. As a further precaution, inclined brace piles were also driven between the vertical piles supporting the piers along this "dock front." As the present main line here leaves but little room for working, only a short piece at the west end of each pier could at first be built. At this point, however, the temporary trestle is now ready for changing to main line, so that the remaining easterly parts of the piers can be built; but these extend so near to the river that caissons will be required, the same as for the river piers, as will be presently described. The westerly portions of the piers were built with a concrete base and in the easterly end a facing of granite is inserted. The upper part of this easterly face is left "toothing;" when the balance of the pier is built (after change of tracks) the same will be carried up (in caisson) wholly of stone, with the west end also left "toothing," and on removal of caisson sides and sheeting the upper part of the gap between the two sections of the pier will be filled up by fitting in and keying cut granite stones, so getting a good bond and making a very neat job. Piers 8 to 22, inclusive, are thus to be spliced.

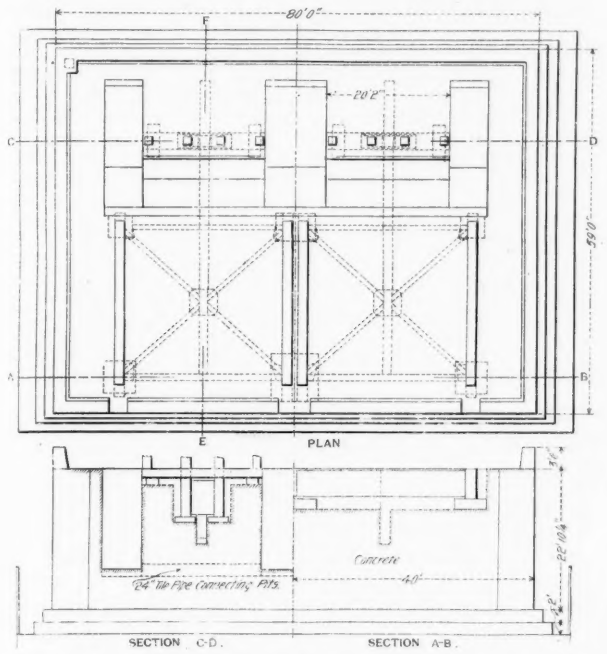


Fig. 3.—Plan and Sections of Caisson for River Pier.

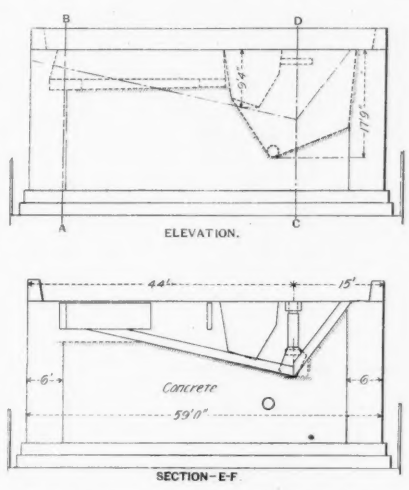


Fig. 4.—Elevation and Section of Pier for Lift Bridge.

The bottom of Pequonnock River, beneath some 15 ft. of soft mud, is found to be a very hard gravel, into which piles are driven as far as they will go, and cut off at grade 65 for the drawbridge rest-piers, and at grade 69 for the other piers; grade 93 is high-water mark and low water is at grade 86. Land pier piles are cut off at grade 82. The track grade (Elev. 116) is 23 ft. above mean high water.

Open caissons are used for the river piers, the bottoms or masonry platforms consisting, for the smaller piers, of three layers of 12 x 12 in. hard pine timber, the first course laid transversely, the second diagonally, and the top longitudinally, and for the drawbridge pier four courses, including a second diagonal layer, all drift bolted at each intersection with ⅞-in. square drift bolts, 18 in. long.

The platforms were rafted and assembled on the water and the framed sides of the caisson attached by rods hung from the plates and hooking over eyebolts in the flooring to permit easy detachment; sufficient interior cross bracing is also provided. The outer sheathing of 3 or 4 in. plank is calked with oakum. The caissons are floated to site and when the masonry has been laid high enough sunk at low water to the piles (which have been previously filled 6 ft. deep about their heads with rip rap and coarse gravel and a diver sent down to level same and leave pile heads clear), and the caissons are then flooded sufficiently to hold the work in place until additional masonry can be laid. The caisson for the large pier for the rolling-lift drawbridge, the pier being 59 x 80 ft., is a mammoth affair, and, as illustrating the expensive nature of such work, it is estimated that this pier and its caisson will cost about $85,000. It will have a heavy stone facing wall, 6 ft. thick all around, the interior to be filled in with concrete, in which the iron work framing will be imbedded; also there will be formed therein pockets or pits (with connecting 24 in. chain) for the bridge counterweights to sink into when the bridge is lifted, the whole design being very carefully and thoroughly worked out.

The work east of the river, consisting chiefly of embankment and retaining walls, the same as previously described, calls for no special remark. Generally the ordinary excavation reaches a good hard bottom for the walls, though a few hundred feet of piling may be required in one place along Crescent avenue. By leaving openings in the six or seven street-bridge abutments one of the old main line tracks is conveniently put to use for bringing in trainloads of granite and other materials.

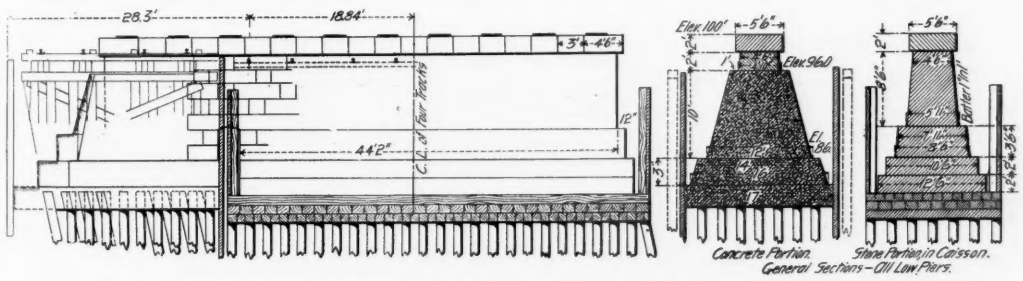


Fig. 6.—Piers South of the Passenger Station.

The Portland cement concrete used on the work is of very superior quality. Alpha and Lehigh brands of cement are largely used, in proportion of 1 part cement, 3 of sharp sand and 6 of clean coarse gravel. The concrete mixer in use is of the rotary box type, 24 men and a small engine turning out 125 cu. yds. of concrete a day, and the same is moved to site over a narrow gage track on which run push cars, ingeniously devised by Mr. Rollins, the contractors' superintendent. These cars carry the filled boxes, which have two leaved hinged bottoms; after the derrick has dumped their contents the swinging bottoms are automatically closed by inclined side pieces on the push cars, as the boxes are lowered on them for the return trip.

The estimates of material and quantities give a comprehensive idea of the magnitude of the undertaking. These show 150,535 cu. yds. of grading, more than one-quarter of which consists of dredging for the piers south of the station; 3,867 cu. yds. of first-class masonry; 24,630 cu. yds. of second class, and 38,355 third class. There are 26,113 piles, including 3,640 over 50 ft. long; 1,845 M. ft. of timber and 173 tons of iron in grillage; 28,000 sq. yds. of granite and macadam pavement, and 7,000 linear ft. of curbing. It is estimated that, in round numbers, the whole outlay for viaduct, bridges, embankments, track changes, etc., including the proposed new station and its accessories, will not be far from $4,000,000, the most of which (about three-quarters) is now under contract. Not much before August, 1903, can the new road-bed and track be sufficiently completed to permit the removal of the temporary tracks that now are obliged to occupy the space reserved for the proposed station; so that at least two years must pass before the whole design can be carried out in its entirety. Nevertheless, the city of Bridgeport, which has waited over 12 years for this great improvement, is to be congratulated upon the splendid public benefit which it is so soon to receive.

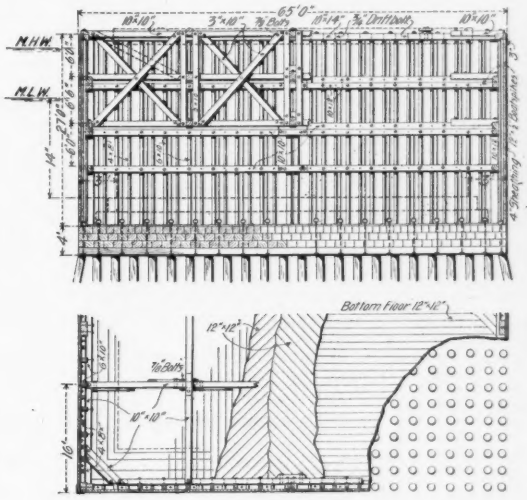


Fig. 5.—Details of Caisson.

Moral Discipline.*

BY B. S. JOSSELYN, *Manager of the Kentucky & Indiana Bridge & Railroad Company.*

A man's private life must be beyond reproach in order that he may get the best service out of his subordinates. Like produces like, and those directly in charge of men influence them by the character of their acts, and even by their thoughts. You can not sow corn and reap wheat.

I am of the firm conviction that a higher standard of morals is necessary in those having charge of men. A superior officer, whose thoughts dwell upon carnal pleasures, either in licentiousness, strong drink or opiates of any kind; or who finds pleasure in gambling, the repeating of "smutty" yarns, or kindred excitement or pastime, is not fitted to mould the minds of those under him in a way that will produce the results expected by our superior officers, for they are all evil and can not fail to produce inharmony and discord of every kind. What we want is to produce good and satisfactory results in our business and home affairs, and that can only be done by sowing only that which is good and pure.

The necessity for a higher standard of efficiency and morals in railroad service is becoming more apparent each day. A man who is "blear-eyed" or nervous from dissipation can not put the same cheerful energy into himself, his work or into his men, as one whose head is clear and who is giving his entire strength to his work. A morbid mind produces a morbid body and morbid thoughts. You can not get right out of wrong, or wrong out of right thoughts or acts. And it is also well to remember that old adage, "You can catch more flies with molasses than with vinegar."

A man that is light-hearted by feeling that his superior is pleased with his work and is his best friend, is worth a dozen men who feel that they are being "rawhided" at every turn, whether they do their work well or not. Discipline should never be administered in the heat of passion or in the spirit of vindictiveness; but in a kind, dignified and loving manner that will cause the man to feel sorry for his work poorly done; and cause him to feel that there is a bond of brotherly love existing between the two; that his superior has his best interests at heart, and is not lying in wait to give him the worst of it. I have long since ceased to derive satisfaction from anything that can be gotten out of a man's hide. Love and charity is always the best plan, for like produces like. More charity and less vindictiveness and driving is wanted in the handling of men. The Golden Rule can be used to much better advantage in any legitimate business than the travesty thereon, which says "Do others, or they will do you."

I have been in railroad service for 30 years, and in direct charge of men of different classes for 19 years. For 16 years of that time it was my practice to handle men in a "czar" fashion, and I must admit with indifferent results. For the last three years I have endeavored to direct the work of my subordinates through the principle of love and charity, and have accomplished infinitely more in the shorter than in the longer period. Some may say, "That is well and good in theory, but will not work in practice"; but love and charity are not sentiment, they are the Law of God, and when theory has been put into practice, it no longer remains a theory, but a fact.

Everything to-day is being reduced to a science; should it be considered impossible to put into practice on railroads the teachings of 2,000 years ago by sowing as we wish to reap? This plan, if persevered in, will surely bring about harmony instead of discord, good and efficient service instead of bad, employees will have a unity of purpose, will love one another, and selfishness,

*A paper read at the annual meeting of the Central Association of Railroad Officers at Put-in-Bay, July 22. Condensed.

the root of all evil and discord, be permanently destroyed; for such as persist in wrong-doing in the face of fair and kind treatment will soon drop out; for like attracts like, and the opposing element will seek other places.

Therefore, let us first get ourselves into line, and our men are bound to follow, for it will be shown that failure and despair will get the hindmost. "An ounce of loyalty is worth a pound of cleverness." This last quotation accounts to me for the rapid advancement of some we have known who did not appear to possess any great amount of ability; their loyalty to their work and to their superiors hid a multitude of shortcomings. So let us be loving and loyal to our superiors and subordinates, and to our work, and not let any material or selfish pleasure or interest interfere therewith, then our success is assured.

Comparative Characteristics of the Panama and Nicaragua Canals.

About the last act that the able and energetic Mr. Bunau-Varilla did before his recent sailing for France was to bring out a little pamphlet under date of June 2, the title of which is reproduced at the head of this article.

Figure 1 shows the relative amount of excavation in the two canals, which approximately measures the quantity of labor required. Figure 2 shows the relative quantity of steel. Figure 3 shows the relative depth of great cuts. Obviously, the greater the cut the greater the risk and uncertainty involved in taking it out, as it is impracticable with exploration to reveal all of the facts. Figure 4 shows the relative cost of maintenance and operation. The saving is $1,300,000 in favor of Panama. At 2 per cent. this represents a capital of 65 million dollars. Figure 5 shows the relative number of locks.

Figure 6 shows canal navigation, taking out distances of free navigation on the lakes. The total length of the Nicaragua Canal is 183.66 miles, and the total length of the Panama Canal is 49.09 miles. The lengths, deducting free navigation, are shown on the diagram.

Figure 7 shows an interesting feature. The Isthmian Canal Commission reports that 28.73 miles across Lake Nicaragua requires a channel in the bottom of the lake; the corresponding figure being 5.68 miles in Lake Bohio. It is suggested by Mr. Bunau-Varilla that for the miles in Lake Nicaragua ships will have to keep a narrow channel while floating in a sea exposed to storms and cross currents. In Lake Bohio the narrow valley will shelter the navigation.

Figure 8 shows the relative length of navigation around curves. Figure 9 shows the amount of curvature and average radius. This is a very striking diagram. Figure 10 shows the sharpest curves.

Figure 11 shows the theoretical time of sailing, without taking into account delays from winds, currents and darkness; also the hours actually spent in the canal, taking into account the delays from darkness. It is the opinion of very competent men that night transit will not be possible for large ships on the Nicaragua line because of rain, wind, sharp curves and flood currents. It is believed, therefore, that navigation will be stopped from 6 p.m. to 6 a.m. Applying the same rule to Panama gives the result shown in the second part of figure 11.

Figure 12 shows the relation of the direction of the prevailing winds to the axis of the canal. Figure 13 shows the difference of rain-fall. It is pointed out that tropical rains will bother canal navigation in other ways than producing floods, that is, they obscure the atmosphere and will interfere with navigation like a fog.

Other comparisons are made which are not capable of being reproduced in diagrams. The regulation of the level of Lake Nicaragua involves the operation of movable gates, but the regulation of Lake Bohio is automatic. Concerning this Mr. Bunau-Varilla makes a strong argument, which we do not now take the space to print. Another comparison that he makes is of the relative risk of detention. The number of ships in the canal at one time will be somewhat in proportion to the length of the canal, and but the chances of accident will bear some proportion to the number of ships; but the chances of accidental obstruction will also be proportional to the length of the canal. Altogether, Mr. Bunau-Varilla estimates that the ratio of risk of detention will be about the square of the ratio of the lengths of the routes.

Handling Air-Brake Work in Connection With the Yard Testing Plant.

Of the three committee reports presented at the Air-Brake Convention at Pittsburgh, Pa., and published in our issue of May 9, discussions of two have already been given in our columns (July 11 and 18). The discussion of the third follows, in part:

Mr. Barry (N. Y. C.)—On page 33 of the report it says, "In all cases where a great amount of cleaning is done, we would deem it advisable to take the triple valve off and replace it with a repaired one." I think that should read "in all cases where anything is done, take the triple valve off." That is in accordance with the M. C. B. rules, which state that triple valve should be removed, cleaned, oiled and tested, and in my opinion this should be done in all cases where cleaning is done. You cannot test the triple valve properly on the car.

Mr. C. C. Farmer (W. A. B. Co.)—If we would make any headway with our triple valve repair work and brake cleaning we must take the triple valves off every car. I would add one thing to the paper in regard to the way of testing the brakes on the cars in the yard; that is, to add the release test. The release should be made by slow raise of pressure in train pipe. We understand it would be a difficult thing to regulate this raise of pressure so it would be the same in all cases, but a man can judge in a measure by watching the gage, and by getting a slow raise of pressure, if he has any cars that have bad triple-valve packing rings. He may be able to get these triple valves out of service before they have caused any trouble on the road.

Mr. Garabrant—I made a test in Jersey City on some triple valves some five or six months ago. In this test of some 75 cars we had 58 per cent. where triple piston packing rings were stuck in the groove. We found cars that had not been cleaned in from one to two and a half years. Others we found that had been cleaned within six to eight months, and in many cases we found those rings also stuck. We came to the conclusion then that the work was not always properly done.

Mr. Pugh—We are making the test suggested by Mr. Farmer and I would say that it is a good test. We use a $^1/_{16}$-in. hole. Previously we were only able to detect broken packing rings by taking the triples off. I am sure that anyone using that method of testing will certainly find out defects.

Mr. Clendening—The report says, "Next to be considered are the men who are to operate the plant." We found in many instances where they have had splendid testing plants that they would take up anybody to do the work. I think anyone who has anything to do with the air-brake should be educated regarding it as far as possible.

I believe it would be a pretty good plan to specify that the testing plant for testing the brakes should not be connected with the general plant of the shops. In our testing plant the entire air plant is all connected so that when they are running the machinery the air pressure fluctuates considerably.

There is another point that I wish to call attention to; in regard to defective hose and angle cocks. In applying second-hand hose heads, I would suggest that a second-hand hose head before being applied should receive an extraordinary and extreme test, which will avoid considerable trouble in making up train. Unless second-hand hose heads are as perfect as new ones, it is almost impossible to do anything with them.

Mr. Dowd—In one place the report says, "When the brakes are applied the inspectors will then proceed to go over the train, adjusting piston travel and renewing all defective packing leathers." I think that could be improved by saying that two inspectors should go, one from the rear and one from the head. If both inspectors start from the head, some brakes are liable to have leaked off.

Mr. Von Bergen (N. C. & St. L.)—I want to give you some figures that I got in January. In January, 1902, we had 26,800 air-brake cars coming through Nashville; 221 of them were not cleaned since 1897, 314 since 1898, and 594 since 1899. In February 23,004 and 274 had not been cleaned since 1897, 298 since 1898, and 872 since 1899. In March we had 24,019, 97 of which had not been cleaned since 1897, 642 since 1898, and 1,344 since 1899. That shows how triple valves are looked after by some roads.

Mr. Barry—In renewing packing leathers we bore out to 8 in. We fit the packing leather to a piston and set it in a board, soaked in oil. When it is necessary to renew the packing leather in some cylinder, the inspector takes out the piston and puts in a piston ready prepared, fixing up the old piston whenever he gets the time.

Mr. Weaver (L. S. & M. S.)—I fail to see that any-

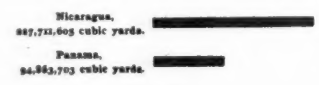


Fig. 1.—Scale: 1 Inch per 240,000,000 cu. yds.

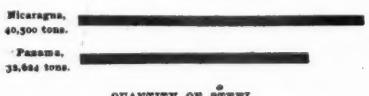


Fig. 2.—Scale: 1 Inch per 24,000 Tons.

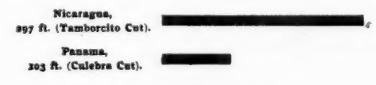


Fig. 3.—Scale: 1 Inch per 240 ft.

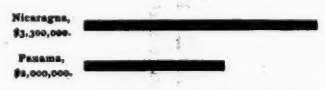


Fig. 4.—Scale: 1 inch per $2,400,000.

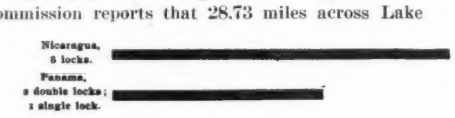


Fig. 5.—Scale: 1 Inch per Four Locks.

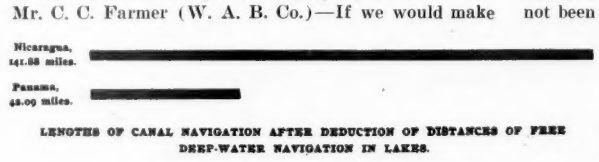

Nicaragua,
141.88 miles.
Panama,
42.09 miles.
LENGTHS OF CANAL NAVIGATION AFTER DEDUCTION OF DISTANCES OF FREE DEEP-WATER NAVIGATION IN LAKES.

Fig. 6.—Scale: 1 Inch per 48 Miles.

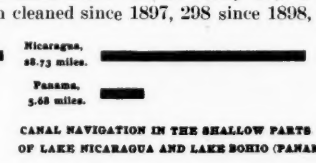


Fig. 7.—Scale: 1 Inch per 24 Miles.

Fig. 8.—Scale: 1 Inch per 48 Miles.

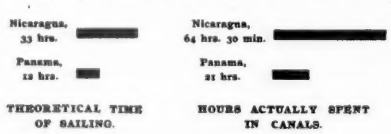


Fig. 11.

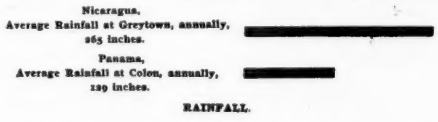


Fig. 13.—Scale: 1 Inch per 240 Inches Rainfall.

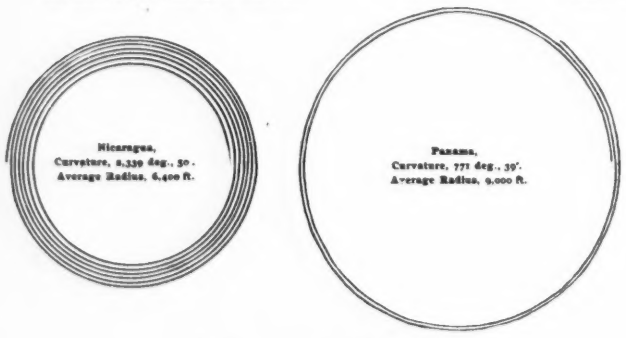


Fig. 9.—Scale: 1 Inch per 9,600 ft.

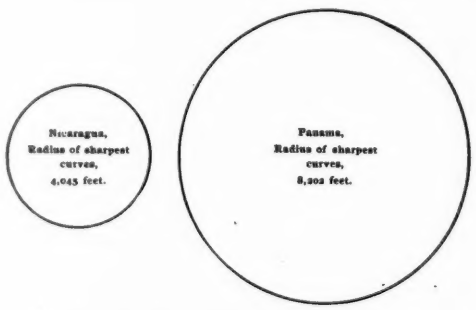


Fig. 10.—Scale: 1 Inch per 9,600 ft.

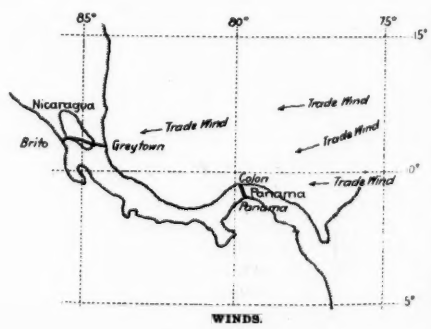


Fig. 12.

in many yard terminal plants after trains are made up. In some terminal plants it is impossible to give inspection to trains until they are made up. Then there would not be time allowed by the transportation department to carry out fully these instructions. Effort should be made at such terminal points to make all necessary repairs before making up the trains, and the yard terminal plant should be used for the purpose of testing the trains. There has been a great tendency in the past by inspectors to use the angle cock in making brake application. I wish to condemn that practice. I find that it is necessary that brakes be tested as near train conditions as possible.

I have not seen any standard method brought up as to what test a triple should be subjected to after cleaning. In cleaning cars at one of our terminal points we cleaned about 80 per cent. of foreign cars, and if we held closely to the recommendation, we would have to condemn at least 85 per cent. of triples. In one test we made, in 50 removed, there were only six that would stand the packing ring test of leakage of 15 lbs. a minute.

Mr. F. B. Farmer (W. A. B. Co.)—The committee go down both sides of train for the purpose of examining the angle-cock handle. We find a great many cars in the test where angle-cock handle is partly closed.

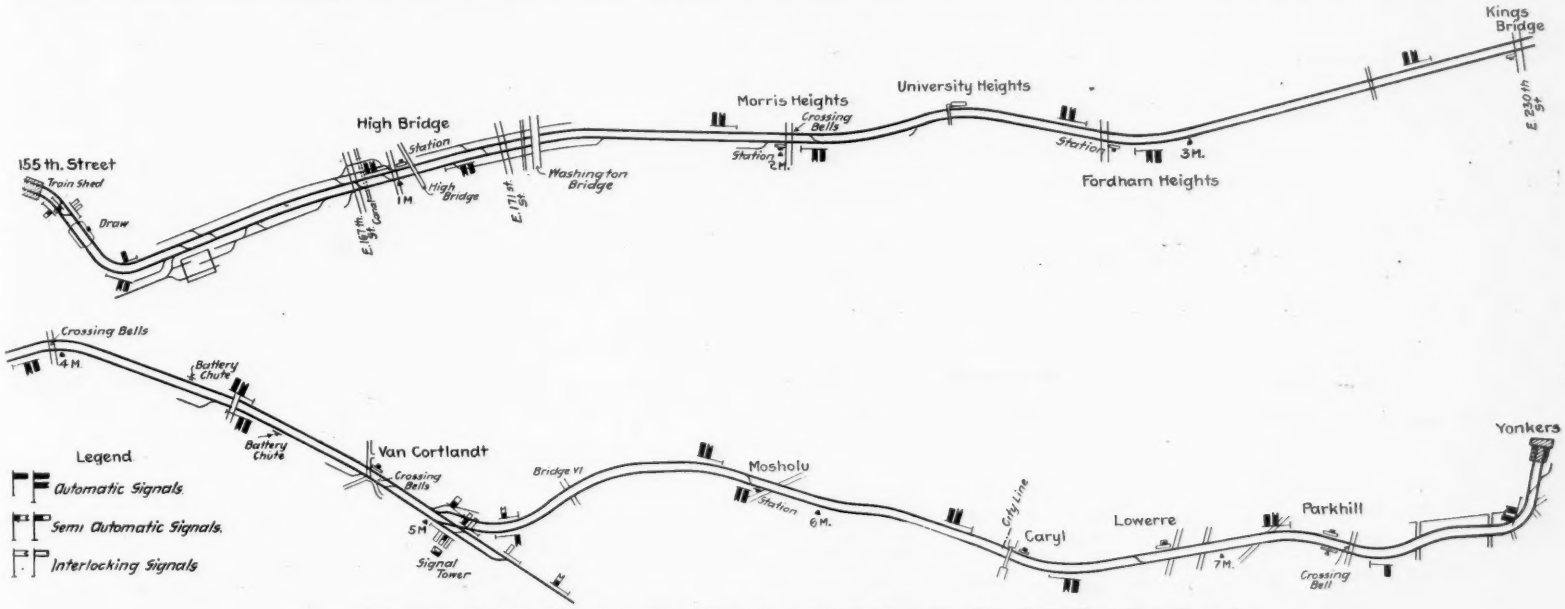
On the repair track when the triple valve is taken off the car the piston should be taken out of the brake cylinder for the purpose of examining the tube that goes through the reservoir to see if it is stopped up. In cleaning the brake cylinder the expander is given very little attention. The instructions are that the expander should be stretched so as to fill walls of cylinder all around. The inspector should be instructed to examine the expander as we have had cases where the brakes would refuse to work on ordinary reduction service, but would work in emergency application, and the different inspectors at different points would apply as many as two or three triple valves to try to overcome the trouble, which was really in the expander.

Mr. Kelley (California)—At many places some of the tests are radically wrong. At some points inspectors are made to carry 70 lbs. and are supposed to make a full reduction and bring down to the equalizing point to look for leaks. By the time one man gets to the rear end train must be held at the terminal point until the brakes are in operative condition. Hand-brakes, of course, can be resorted to if air-brake cannot be used, but it means a serious delay. The cars must be held somewhere prior to passing over these heavy gradients and why should not the eastern roads hold their cars at the test plant and give them a little more thorough test than has been observed in the past?

Mr. Turner—We made an effort not long ago to test retaining valves and we found that there were 75 per cent. of the retainers defective, and it required so much time we had to give it up. So now we make no test, simply replace the defective ones by new ones. We could not get a train through in a day if we attempted to repair retainers. This shows that some roads are very careless in regard to retainers.

Automatic Block Signals on the Putnam Division.

The Putnam Division of the New York Central & Hudson River Railroad is to be equipped for eight miles with the Hall Signal Company's electro-gas motor signal,



Automatic Electric Semaphore Block-Signals on the Putnam Division of the New York Central.

have endeavored, as evidenced by the paper, to outline what they thought to be a most thorough test, but I feel that they may possibly have been a little too thorough in some instances. The business of a railroad is to get freight over the line and I take it that the conditions are about the same the country over; they do not want to hold cars that are in condition to move freight, and a defective air-brake is unfortunately not considered cause sufficient to prevent the car from carrying freight; therefore I believe in testing the train. The test should be modified as much as possible and still be able to catch the most serious defects and remedy those that must be removed. I think instead of making an 8 or 10-lbs. reduction when you wish to test for cylinder packing leaking that it should be a 15-lbs. reduction. Leakage is always greater the higher the pressure. If you make a 5-lbs. reduction your train pipe leakage is greater and it continues to send air into brake cylinder. If you make two tests, 5 and 10 lbs., and then make full service, you take too much time for a road test on train made up. Therefore I would recommend a 15-lbs. service reduction, or 20 if you will.

To test for packing leather leakage, I think the most practical means is, after your heavy service reduction and a sufficient interval has elapsed, to try the brake leverage to see if the shoes are held solidly against the wheels. If you can move shoe back, it is manifest the brake is holding very lightly. It is not always a test that can be made, but for a test of brake cylinder leakage I think it is the best. I would suggest in the order of test, the first thing to be done is to look over the train line for triple leakage. I believe, too, that to facilitate the work some marks understood by car inspectors should be made with chalk, so that as the inspectors pass along looking for defective brakes they can have somebody else commence at once making repairs; or else after the train is inspected have all repairs made that you can, and card for all you are unable to make, and then remove the chalk mark. In testing where more time is had I believe the test should be limited to five cars at most, particularly for brake cylinder leakage.

Mr. Sherman (L. & N.)—In regard to blowing out train pipes, we generally have two inspectors, and after the hose is properly coupled up to the angle-cocks, and before we turn the air into the train line the rear cock is left open and the pipe blown out before the train is charged up at all. We generally try to make it a practice to get our cars in first-class condition on the repair track. When cars are put in proper condition on the repair track they will come pretty near standing the packing leather test when the train is made up. There is usually not sufficient time to make the test recommended by the committee. It is as much as one possibly can do to go over train and test for leakage, defective triple valves and pistons, condition of the pipe-hangers, and also the way the angle-cock handle is located relative to the T. In my opinion the air-brake inspectors should you have got too low a reduction. I claim that is wrong, as we make a 12 or 15-lbs. reduction on the road, and that is all the reduction we should make in the yard.

Mr. Sherman—I would ask in regard to slid flat wheels, what kind of test is made to locate the trouble. When a car comes in with slid flat wheels, we test the triple valve just as it comes in off the road. We note the style of triple valves under that car, size of brake cylinder and auxiliary reservoir, and piston travel on that car and other cars in train, to find whether that car was doing the braking for the train or not, and the engine is also tested.

Mr. Turner (A. T. & S. F.)—In regard to our testing plant, as soon as a train reaches the yard we have a man go over it and give what we call a terminal test. Just as soon as the inspection is finished we go to work and make repairs, and as soon as the train is made up, air is put in from the test plant, of which we have a very good one. We have air pipes to every track in the yard. We have a main reservoir of about 2,000 cu. in. capacity, with check valves intervening so that the pressure is maintained. The brakes are then set from engineer's valve on plant and men go over them and remove all defective triples that will cause damage to car. The first thing that is done is to make a 7-lbs. reduction. We usually have four engines on a train. The repairs that can be made are then made, putting in hose gaskets of which we had as many as 4,000 in one month last year. The engine is then properly coupled on to train and the engineer will make a test of 20 lbs. reduction. We always have a man on the rear end. Men go over train and adjust the piston travel.

We have 12 inspectors, four of them air men. No man is permitted to be an inspector until he can answer one question; that question is, "Can you trace the air from the atmosphere to a pair of flat wheels?" No man is allowed to inspect until he can answer that question. No triple is cleaned under a car; defective triples are always removed. The cylinders are cleaned, but the same piston is never put back. The time required for making this test is from 45 minutes to one hour and five minutes.

Mr. Hedendahl—It is a very rare thing that retaining valves are thought of east of the Rocky Mountains for reason that very few of the railroads have any use for them. The mountain railroads, however, are vitally interested in retaining valves. In handling a freight train consisting of modern heavy-capacity, loaded freight cars on a 4 per cent. grade when tonnage is made up in 10 cars, one brake defective in a 10-car train reduces the braking efficiency 10 per cent. One retaining valve in that train not performing its functions properly is a serious matter. I believe that the eastern railroads that are more fortunate in not having grades ought to look after retaining valves on freight cars as well as brakes in general. A great many foreign cars are handled over a certain western line having 4 per cent. grades. Each

as announced in the *Railroad Gazette* of July 11. The engraving given herewith shows the approximate location of the section of road to be equipped, and of the signals. There is only one interlocking plant on this portion of the road: that at the junction of the Yonkers branch with the main line of the Putnam Division. At this point the existing signals will be controlled by electric slots. As before stated, the block sections will be about 4,500 ft. long. The blades of the home signals will be painted red, and those of the distant signals yellow.

Elevated Railroad Structure to be Moved Bodily.

The incline connecting the Garfield Park branch of the Metropolitan West Side Elevated Railway Co., Chicago, with the surface is to be moved in its entirety some little distance in order to straighten the present structure. It is 1,018 ft. long, extending from Forty-eighth to Fifty-second avenue.

When this incline was originally built, in the spring, a right of way permitting a straight descent could not be obtained. At present it has a considerable swing to the north as it leaves the main structure and gradually comes back into line as it approaches Fifty-second avenue. The desired right of way having been secured recently the engineering department immediately made plans for straightening the line.

When the structure was designed such a contingency as has arisen was provided for by splicing certain of the girders that would require shortening. All that is necessary now in this respect is to remove the splice plates. The line will be shortened 9 ft. by the change. Twenty-two new concrete foundations have been built, having a depth of 7½ ft. from the base of the supporting columns and a spread of 8 x 8 ft. at the bottom.

In moving the structure it will first be jacked up about 18 in. above the present foundations. A skidway of steel rails will be laid upon suitable cribbing and 3-in. steel rollers will be used to make the transfer. The structure, which is double-track, has 22 spans and 21 bents, the whole weighing about 700 tons. The total throw is 56 ft. and it is expected that the entire task, including building the foundations, will be accomplished in 10 days, from the time started. The track will remain intact except that part where the curves occur, which will have to come up to have the rails straightened. The object of the Metropolitan Co. in building this incline is to connect with the Aurora, Elgin & Chicago interurban electric line, which ends at Fifty-second avenue. At the foot of the incline there is a loop having a 90-ft. radius, around which the Metropolitan cars will pass and which has stations on the inside at each side, or on the north and south sides. The interurban cars cross to the inside of this loop, the inbound cars discharging at the south station, and the outbound loading at the north station, through each of which stations passengers can pass from one line to the other.

Early History of the Delaware, Lackawanna & Western Railroad and its Locomotives.*

BY HERBERT T. WALKER.

PART IX.—SUCCESSFUL HARD COAL ENGINES.

The performance of the hard coal burners, "Delaware" and "Black Hawk" having produced a favorable impression, the directors requested Watts Cooke to develop the ideas therein embodied, to the best of his ability, and to order two engines of the most improved design. He accordingly had many consultations with Danforth, Cooke & Co., and lines were laid down for two engines which were built and delivered in March and April, 1857. Their names were suggestive: "Investigator" and "Decision." They were of similar design and the first named engine is illustrated in Fig. 23. This engine was a development of the "Delaware," and was the first really successful anthracite coal burner on the Lackawanna Railroad. The success of this engine lay in the

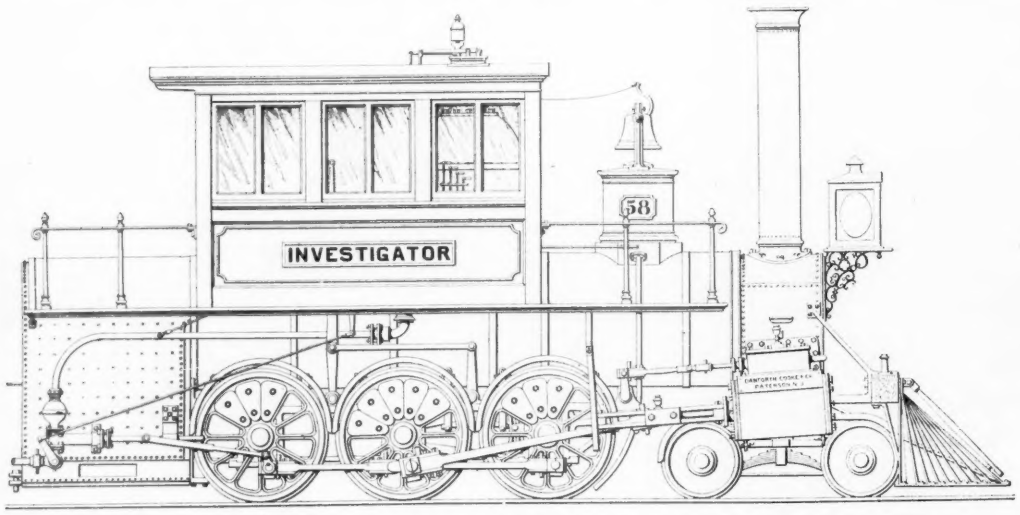


Fig. 23.—Delaware, Lackawanna & Western Railroad—First Successful Hard Coal Burner, 1857.

fact that the wide overhanging fire-box was made as ample as possible consistent with steady running; the driving wheels were placed as far back as they would go and the front of the engine was carried on a four-wheel truck. On comparing the drawing with the engine "Lehigh" (Fig. 19) it will be seen that the Cooke's followed Colburn's ideas, the main difference being the addition of the truck. The "Investigator" had cylinders 17 in. diameter by 24 in. stroke. Driving wheels 46 in. diameter. The fire-box was 5 ft. 3 in. long, but unfortunately there is no record of the heating surface or weight. Mr. Colvin ran this engine for a time and reports that its usual load was 52 empty cars or 20 loaded cars out of Scranton. The valve motion was "indirect," having an extension rod from the link block to the lower rocker arm. This rod cleared the front axle as on the engine "Kittatinny" (Fig. 21). The tender was of the same design as for that of the engine "Anthracite" with the exception of the wheel journals, which were outside instead of inside.

In June, 1857, a wood burning freight engine named "Musconetcong" was purchased from the Rogers Locomotive Works, and it is illustrated in Fig. 24. This locomotive had the reputation of being the best of its class at that time and was the last engine made by Rogers for the Lackawanna Railroad. The cylinders were 18 in. diameter by 24 in. stroke; driving wheels, 54 in. diameter; weight, 72,000 lbs. No record has been kept of its heating surface, but it was a powerful engine. Mr. Henry F. Colvin, who ran it in 1861, hauling the "express freight" on the Southern Division, reports that it did excellent service for many years.

At the present time, when the hard coal burner is with us as a common and every day matter, it is impossible to realize the difficulties encountered in its introduction. There is no doubt the poorly laid track of the period was the chief obstacle to the large fire-box, for the sharp curves with a 6-ft. gage necessitated a short wheel base, and thus the overhanging fire-box caused the engine to "galop" and pound on the track. It is not clear why trucks were not placed under the hard coal burners prior to the "Investigator," unless the track curvature was changed by that time.

But we are approaching the end of the battle, and victory is within sight. The rest of the story is best told in Mr. Watts Cooke's own words, delivered in the course of several pleasant and profitable interviews:

"As far as burning anthracite coal with economy, and doing the work required of them for the heavy grades which they had to contend with, there was no reason to find fault, but it was found that the injury to the track by that form of engine with the overhanging fire-box was so great, that it was a question whether they would not have to abandon it.

"My interest with the company was to make the burning of anthracite coal a success, and before we purchased any more engines, I took the engine 'Ontario,' which was built in 1852 to burn wood, throwing the boiler away and building a new one with a long fire-box, raising the boiler up so that the back axle would pass underneath, putting in a water grate, widening the water space, making it almost double in width of what had been the custom in engines burning wood, making an engine almost similar to the modern engine of to-day. After this engine was put to work all felt that the problem was solved. This engine was examined by all the locomotive builders at that time.

"The company, in December, 1859, had built by the Cooke Locomotive Works six engines, named the 'James Brown,' 'John E. Williams,' 'George N. Miller,' 'John J. Phelps,' 'John I. Blair' and 'Moses Taylor.' The style of these engines was the same as the engine I have referred to called the 'Ontario.' After these engines were put at work in the spring of 1860, the question as to what extent anthracite coal could be used was fully answered. It was found that not only the transportation of coal, but all their freight and passengers, could be done much better than with wood. A great deal of fear had been expressed that while they might be able to transport or to move coal with coal burning engines, they would not be able to haul their passenger trains, so much was this the case, that in 1857 they purchased two engines to burn wood to haul the passenger trains, on the opening of the Southern Division of the road. These engines were called the 'Southport' and 'Col. Scranton,' having 17 x 22 cylinders, two pair of drivers 5 ft. 6 in. in diameter. I at once took two of our old engines and changed them from wood to coal, that we might try them on the passenger trains, and found that they were a success.

"The company being anxious to get a market for their coal, commenced to operate on other roads. Through Moses Taylor, the principal director, we obtained the right to put two engines on the New York Central Railroad, as you will see by this copy from the order book of Danforth, Cooke & Co., which shows the doubts the New York Central Co. had in the success of coal burning engines:

" 'Ordered from Danforth, Cooke & Co.

" '1862.

" 'July 31. By New York Central Railroad Company, per C. Vibbard, Supt. Letter 8 Aug.

Two first-class Locomotive Engines for burning hard or anthracite coal. Weight to be as near 28 tons as possible. Cylinders 16 x 22 in.; four driving wheels 5 ft. diameter, outside connected, with Messrs. Corning, Winslow & Co. semi-steel tire or with bowling or low moor tire as preferred, and four-wheel center bearing truck. Boilers to be made with combustion chambers. Water grates and wrought-iron lap welded flues. To have cast-steel slides. Furnished with heater cocks and pipes, sand box, steam gage, jack-screws, and all necessary tools for putting her in running order, and furnished with eight-wheel tenders on two trucks with outside journals. Tank to hold 2,000 gallons. The boilers and furnace to be covered with felt, wood lagging and Russia iron with brass bands, and domes and cylinders with brass. The steam chests covered with Russia iron with brass mouldings, or with brass as they may prefer.

Delivered at Jersey City for.....$10,000.00 each
or if delivered at Clarkson street for..$10,125.00 each.
Terms, cash in 30 days after delivery.

One to be finished in November and the other in December next. Should the engines not prove satisfactory to them as hard coal burners, we are to alter them to soft coal burners free of expense.

" 'The engines to be made with Corning, Winslow & Co.'s semi-steel tires, all flanged, and to be delivered on the track of the Hudson River Railroad, foot of Clarkson street, at $10,125.00 each.

" 'As per C. Vibbard, Superintendent. Letter 8 Aug.'

"These engines were delivered in the following January and I went with them to Syracuse, where I remained between Syracuse and Rochester for the period of about two months, showing to the New York Central R. R. Co. that the burning of anthracite coal was a success and past any experimental stage. I do not think from that time the New York Central ordered a new engine to burn wood; on the other hand, they at once commencing to change from wood to coal. During the same winter I was directed by Moses Taylor to take an engine on to the Erie, and see what could be done to convince them that their fast trains between Hornellsville and Susquehanna could be hauled with the use of anthracite coal as fuel. I took the engine called after him, which run between Hornellsville and Susquehanna one month, doing far better work than any engine they had of her class. They at once commenced to change from wood to coal.

"They had used some hard coal burners like Millholland's with sloping fire-boxes, but they gave much trouble and were gradually scrapped."

The engine "John I. Blair," a mate to the "Moses Taylor," is shown in Fig. 25. The cylinders were 18 in. diameter by 24 in. stroke. Driving wheels 54 in. diameter. The fire-box was about 7 ft. long, fitted with a combustion chamber 20 in. long. This engine originally had a hollow plug variable exhaust, but it did not stay long and a plain nozzle was put in its place. These engines were well designed and the only weak point in their construction was the unmechanical looking brace for the guide yoke. The lock up safety valve had elliptical springs, but it never blew off, as the springs were screwed down tight to prevent the condensed water running down over the boiler jacket.

In the year 1864 Watts Cooke was appointed superintendent, which position he held for four years, when he retired and organized the Passaic Rolling Mill Company at Paterson, N. J., where the rest of his life was spent.*

As late as the year 1865 the average speed of ordinary passenger trains was 20 miles an hour, including stops, and that of the express trains 23 miles an hour. Freight trains averaged but eight miles an hour with loads of about 160 tons. The average weight of passenger trains was 75 tons. A comparison of these speeds and weights with those of the present day will show the progress made during the last 35 years.

The last engine to be illustrated was built in 1869, and

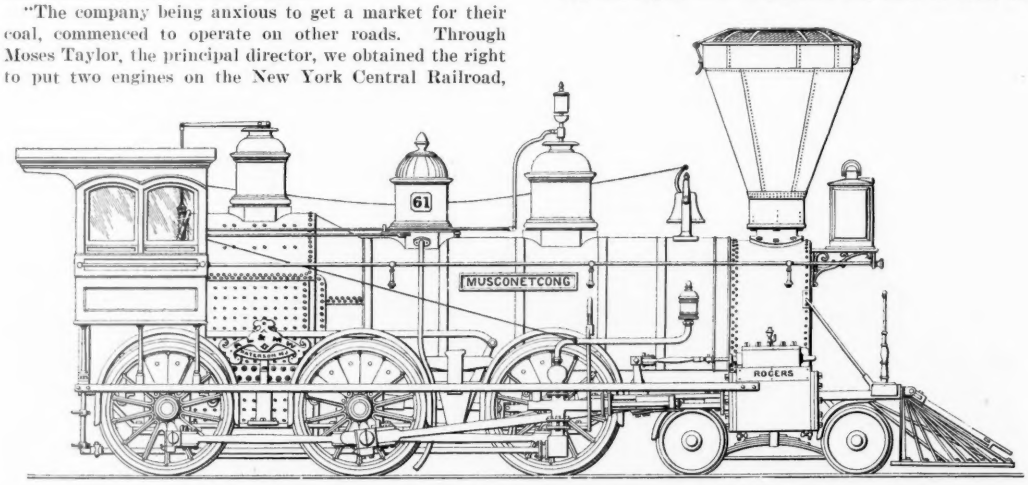


Fig. 24.—Delaware, Lackawanna & Western Railroad Wood Burning Freight Engine, 1857.
Built by the Rogers Locomotive & Machine Works, *Paterson, N. J.*

is shown in Fig. 26. It is of interest as being the first locomotive to be built at the Scranton Machine Shops. The designer was W. Dawson, an efficient and respected master mechanic of the railroad. The engine was powerful and a satisfactory hard coal burner, and was of the same class as the "John I. Blair." The cylinders were 18 in. diameter by 24 in. stroke. Driving wheels 57 in. diameter. Length of fire-box, 9 ft. Its name was afterwards changed to "New York," when it was re-built to burn fine anthracite coal.

In the year 1864 the Hon. Samuel Sloan became a director of the railroad, and in 1867 he was elected President. Mr. Sloan was born in Ireland in 1817, and when he was but 15 years of age, his father died, throwing him upon his own resources and developing that rugged independence of character and firm reliance on himself that made his life a success. Throughout his long years Mr. Sloan has enjoyed the respect and esteem of all who have known him. By his influence the writer has been enabled to acquire much of the information herein recorded. Thanks are also due to Mr. William F. Hallstead and the late Superintendent Andrew Reasoner for similar acts of attention. Mr. Hallstead was general manager for many years, and retired from the company's service at the same time as Mr. Sloan resigned his position as President—which occurred in 1899, when Mr. W. H.

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*See *Railroad Gazette*, Oct. 19, 1900, page 692

Truesdale became the latter's successor. Mr. Sloan is still chairman of the board of directors.

When Mr. Sloan was elected president he appointed the late Andrew Reasoner as superintendent of track and construction. Mr. Reasoner was born in 1823 at South Egremont, Mass., and during his earlier career he filled various positions on the Hudson River and other railroads, and was acknowledged to have been one of the best superintendents the Lackawanna Railroad ever had. On several occasions he proved himself a prompt and energetic leader, and took part in a regrettable position the company got into with the Erie Railroad Company, but before describing the incident it is necessary to explain that when the Morris & Essex Railroad became amalgamated with the Lackawanna system, as previously recorded, Washington, N. J., was made the transfer point for all freight consigned to the Morris & Essex Division (which was standard gage), the freight having to be loaded into standard gage "coal jims," but broad gage he loved the men and they loved him. In 1871 he was appointed general superintendent of the Morris & Essex Division, and held that position until April 1, 1899, when, with the change of management, he retired from his labors. Like other intensely active men he did not live long in retirement, for in less than a year (Feb. 9, 1900,) word was sent over the wire that Superintendent Reasoner was no more, and many an old Lackawanna employee bowed his head and wept when he heard the sad tidings of the passing away of him who had been more of a father, a friend and a counseller than an employer.

The funeral services, which were very simple, in accordance with Mr. Reasoner's wishes, were held from the Munn Avenue Presbyterian Church in East Orange on February 11, and were very largely attended, over 600 of the Lackawanna employees being present. Among the pall-bearers were President Truesdale and ex-President Sloan, and on the following day the interment was made at Woodlawn Cemetery.

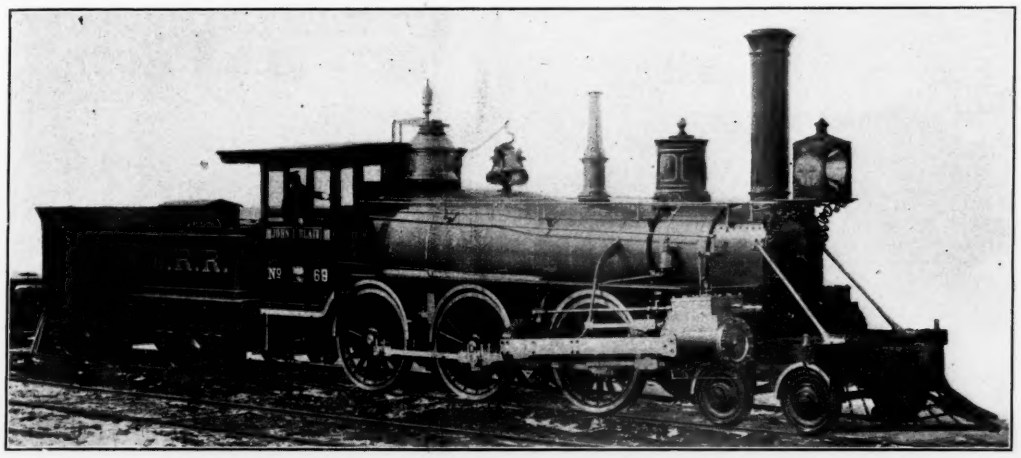


Fig. 25.—Delaware, Lackawanna & Western Railroad Standard Coal Burner, 1860.

through trains to and from New York continued to be hauled over the Central Railroad of New Jersey for some time until the Boonton Branch (a "cut-off" road between Dover and the Bergen tunnel) was opened, and the Lackawanna Railroad then had a mixed gage, or third rail, from Hoboken to Scranton, freight trains being made up of broad and narrow gage cars coupled together with a special link coupling. In the year 1870 the Boonton Branch was under construction and the company naturally expected to reach Hoboken via the Erie tunnel, because when Stevens sold the Hoboken line to the Morris & Essex Railroad Company the contract to use the tunnel went with the sale, as it did to the Lackawanna Company when they, in their turn, leased the Morris & Essex Railroad, but as the Boonton "cut-off" road had a mixed gage, it was necessary to lay frogs at the tunnel to connect with the Erie tracks, which were of a like character.

For certain reasons the Erie Company declined to allow their tracks to be disturbed, and after much correspondence it became evident there was going to be trouble, and, passing over details, it will suffice to say that Superintendent Samuel Schoch made preparations for active measures, appointing Andrew Reasoner as his second in command. Arrangements were completed so that on the morning of Dec. 2, 1870, Assistant Superintendent Reasoner, who had his men and materials ready at the west end of the Bergen tunnel, put out flags at both ends, and commenced pulling up the Erie tracks preparatory to making the connection. When the frog was laid down it was found the switch rail was too long, and while this error was being rectified the Erie Company had ordered an engine to be run on to the frog and kept there, to prevent the completion of the work. When the switch rail was ready Mr. Reasoner had the frog spiked to the ties under the engine, the men doing this work at the risk of their lives, as the Erie engine driver threatened to run over them, which, however, he did not do, and the men stuck to the frog until the last spike was driven.

By this time several Erie and Morris & Essex Division trains were blocked at both ends of the tunnel, the Erie Company ordering that the engine should remain on the frog, and for 9½ hours not a train was moved, causing much inconvenience to passengers. The matter was finally settled by the good offices of Theodore F. Randolph, Governor of New Jersey, and trains of both roads then proceeded through the tunnel without further hindrance.

This affair is known as the "Tunnel War" and happily passed off without bloodshed, although both sides were wrought up to the highest pitch of excitement. A full and well written account of this incident will be found in the *Railroad Employee* (Newark), August, 1900, page 6.

It being obviously to the interest of all parties that the Lackawanna Railroad Company should have a tunnel of their own, authority was obtained under date of March 21, 1871, for its construction. This tunnel was completed in 1876, about which time the broad gage was finally abolished.

The Boonton Branch was then used for all through trains, but recently some of the through expresses have been sent over the old Morris & Essex route.

This is a fitting place to record a few words in connection with the late Mr. Andrew Reasoner, who was a good example of an old-time railroad officer, taking a paternal interest in his men (whom he called "my boys"), who honored and respected him accordingly. In short,

We have now arrived at a period when the history of the Lackawanna Railroad ceases to be "early," and it only remains to briefly describe the railroads that have come under its control during the last 30 years. Some of these roads were opened at an early date, but as no interesting drawings of their engines could be obtained it was thought best to briefly notice them here instead of breaking the continuity of the history of the main line by introducing them in their strict chronological order.

The Oswego & Syracuse Railroad was chartered April 29, 1839. The charter was amended May 14, 1845, and according to Poor's "Manual" the road was opened May 14, 1848, but contemporary newspapers state that traffic was not commenced until the end of October of that year, when trains ran from Syracuse to Fulton. The estimated cost of the entire road (35 miles) was about $400,000. The grades are easy and the road had originally a 6-ft. track and a 57-lb. rail. John Lathrop was the chief engineer.

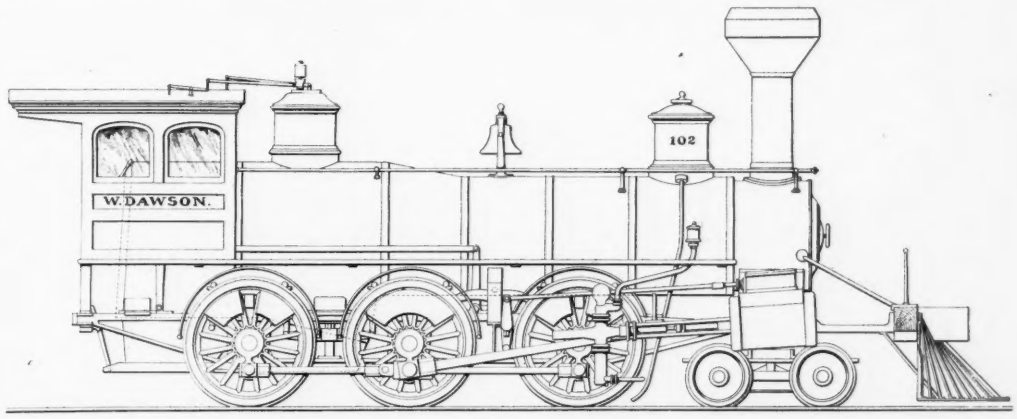


Fig. 26.—Delaware, Lackawanna & Western Railroad—First Engine Built at Scranton Shops, 1869.

The books of Rogers, Ketchum & Grosvenor show that two engines, the "Oswego" and the "Ontario," were delivered in 1849, but an engine list signed by W. B. Phelps and kindly sent from the Superintendent's office does not show any engines bearing these names. According to this list there were two engines named "Luther Wright," built in 1849, and "Frontier," built in 1850, the names of the builders not being given. These two locomotives may be the same as the above mentioned Rogers engines, but with altered names. The practice of changing the names of engines when they were received from the builders has caused much confusion and is a source of trouble to all who attempt to write railroad history.

A passenger engine named "F. T. Carrington" was built by Rogers, Ketchum & Grosvenor, and delivered in 1855. In 1872 it was rebuilt, and in 1885 it was changed into an observation engine, and is still in service.

This railroad was leased to the D., L. & W. R. R. Co. Feb. 13, 1869, at an annual rental equal to 9 per cent. on the capital stock, and 5 and 7 per cent. on the bonds, and it is now a part of the Syracuse Division. The old engine "Wyoming" (Fig. 13) was bought from the main line, April 10, 1869, the price being $7,000.

The Syracuse & Binghamton Railroad was chartered Aug. 13, 1851, and was opened Oct. 18, 1854. It had a 6-ft. gage. The heaviest grade is 52 ft. to the mile, between Jamesville and Apulia.

One of the engines was named "Marathon," built by Norris, and was bought from the Erie & Northeast Railroad (now a part of the Lake Shore & Michigan Southern R. R.) when the city authorities would not allow them to build a 6-ft. track. The other early engines came from Hinckley, of Boston, but the drawings have disappeared.

The road was sold under foreclosure, and on April 30, 1857, it was reorganized with the title of the Syracuse, Binghamton & New York Railroad. A contract was then made with the D., L. & W. R. R., under which the road was operated. In 1861 the company had 12 engines (inside connected), and the track was then laid with a 60-lb. rail.

In 1869 the D., L. & W. R. R. Co. obtained control of this line by purchasing the major part of its stock, and, with the Oswego & Syracuse road it completes the Syracuse Division.

The Lackawanna & Bloomsburg Railroad, extending from Scranton to Northumberland, Pa., was chartered in 1852-53. Major E. McNeil was the chief engineer, and work was commenced in 1854, in which year the D., L. & W. R. R. Co. subscribed $125,000 to the capital stock. The track gage was 6 ft.

The section between Scranton and Bellevue mines was opened for the transportation of coal in November, 1854, and the road was completed in 1857. As the line follows the course of the Lackawanna and Susquehanna Rivers the grades are easy, being about 3½ ft. to the mile.

No drawings of the original engines can be obtained, but Mr. Charles Graham, master mechanic of this division, has kindly placed a number of photographs and engine lists at the writer's disposal. As the photographs are of comparatively modern engines of standard designs, it is not necessary to publish them, but Mr. Graham states that the first engines on the road were named "Susquehanna" and "Nanticoke," both built by Swinburne. They had inside valve chests and a four-wheel rigid center truck with the wheels in front of the cylinders. This gave a long wheel base and they frequently ran off the track.

In 1873 this road was consolidated with the Lackawanna Railroad and then became the Bloomsburg Division.

The Utica, Chenango & Susquehanna Railroad was organized Jan. 11, 1866, but was not opened until Oct. 10, 1872, before which date the Greene Railroad, a short connecting line (organized Oct. 18, 1869,) was opened in 1871. These two railroads together with the Richfield Springs Branch, now form the Utica Division of the Lackawanna Railroad, having been leased on April 9 and April 26, 1870, at an annual rental equal to 6 per cent. on the capital stock. The heaviest grade is 83 ft. to the mile between Sauquoit and Clayville.

The Chester Railroad, joining the Morris & Essex Division near Port Oram, was chartered in 1868 and opened in 1872. It is but 10.02 miles long and the grades are insignificant. A lease was soon afterwards taken, the lessees agreeing to pay 7 per cent. on the bonds.

The Passaic & Delaware Railroad Company was organized Oct. 9, 1878, as successors of the New Jersey West Line Railroad Company, the property of which had been for some time in the hands of mortgage trustees. No report of the operations or financial condition of this road was ever made. It was leased Nov. 1, 1882, at an annual rental of 5 per cent. yearly dividends on the capital stock. This line runs from Summit to Bernardsville, the grades being moderate. In 1890 the road was extended to Gladstone, the maximum grade on this extension being 60 ft. to the mile. This line is also operated by the company under an agreement to pay 4 per cent. on its capital stock, etc.

The Valley Railroad, beginning near Great Bend, on the Northern Division, and thence to Binghamton, was organized March 4, 1869, and opened in 1870. It was leased April 15, 1869, at an annual rental of 8 per cent. on the capital stock. This road is nearly level and less than 12 miles in length, but it was a short link added to the chain that was soon to be completed between Hoboken and Buffalo, for on Aug. 26, 1880, a charter was granted to the New York, Lackawanna & Western Railway Company to build a railroad from Binghamton to Buffalo, and on Sept. 17, 1882, the road was opened for through freight business and for passenger traffic soon afterwards. On Oct. 2, 1882, it was leased in perpetuity to the D., L. &

W. R. R. Co. at an annual rental equaling interest on its bonds and 5 per cent. on its stock. This road is now a part of the Buffalo Division, and with the exception of a grade of 60 ft. to the mile at Dansville, is fairly level, enabling all trains to make fast time.

The main line was thus completed and the railroad entered the field as a competitor for through western traffic, with a service and equipment comparing favorably with any of its rivals.

With the acquisition of several short branches, and the recent purchase of the Bangor & Portland, and Eastern & Northern lines, the railroad has now a total length of 946.91 miles, with a total track mileage of 2,199.54, and, according to the latest New Jersey State Report on Railroads it has a total capitalization of $35,140,543. The assets amount to $51,181,005. The amount of freight carried was 13,925,167 tons The freight revenue for the year was $16,263,747; the earnings per mile of the road were $20,410.47; passenger earnings and revenue for the year were $5,406,013; the freight revenue and earnings $16,290,409; other earnings from operation, $21,961,847; income from other sources, $2,677,577, making the total earnings and income $24,639,424. The total of operating expenses were $13,592,398—63.53 per cent. of the receipts from operation. The dividends paid were $1,834,000, leaving a surplus of $1,324,808.

This magnificent property, popularly known as the "Lackawanna Railroad," which, with the recent change of management under President Truesdale, is being rapidly developed and placed in the front rank of American railroads, will, in the near future, be extended west and south, with probably four tracks and an improved suburban service on the Morris & Essex Division, including the Boonton Branch.

As an example of the growth of the Lackawanna Railroad we will take the Morris & Essex Division, the first engine on which it will be remembered weighed about six tons, and the number of passengers per day, taking Conductor Crane's book as a basis, averaged about 10. Engines of 75 tons now travel on the same road, and the number of passengers carried per day is about 38,000.

One way in which history is valuable is that it shows us what to avoid, and to profit, if we will, by the mistakes of our predecessors. Furthermore, as everything goes by comparison, the best way to judge of the present is to measure it with the past, and such a retrospect cannot fail of an optimistic effect, enabling us, as it does, to discern the progress made up to the present time, and although such progress has been in the right direction, our satisfaction should be qualified by a better respect for our forerunners who labored under difficulties and discouragements almost unknown in our day, their investigations and work being conducted under adverse conditions, and on lines more or less original, there being but few precedents for their guidance.

In conclusion, it may be said that as the collection and preparation of these historical notes were commenced over four years ago, many changes have occurred since that time, and some of the good men who so freely and cheerfully furnished information herein embodied have gone to their eternal reward before the "history" which they so much desired to see in print could be published.*

In addition to the gentlemen previously mentioned by name (without whose help the present article would never have been written) the Baldwin Locomotive Works, Mr. G. H. Longbottom, Secretary, and Mr. Reuben Wells, Superintendent, of the Rogers Locomotive Company; the Cooke Locomotive and Machine Company; Mr. Charles A. Colton, of the Newark (N. J.) Technical School; Mr. J. Snowden Bell and Mr. C. H. Caruthers have contributed valuable matter which is hereby gratefully acknowledged.

That the present article contains inaccuracies goes without saying, for even "official" records are not always in agreement, and many conflicting accounts of the same events and dissimilar drawings of the same engines have been given to the writer, involving an amount of research and perplexity which no reader can appreciate unless he has engaged in such work. Should these notes meet the eye of any one possessing drawings or other data that will serve to correct errors or supplement details herein published, he will confer a favor on all who take interest in historical matters by placing himself in communication with the editor of this journal.

The publication of Mr. Walker's article was begun May 30, page 388, and has been continued in each issue until the present.

An Aerial Tramway.

In *Popular Mechanics* (Chicago) for July 10 is an illustrated description of an aerial tramway built for the American Gold Mining Co. at Ouray, Colo., in 1900, by the A. Leschen & Sons Rope Co., of St. Louis, Mo. The installation is made in Deep Gulch in the Rocky Mountains, the line being 4,200 ft. long and extends from the works of the company in the valley up 2,000 ft. to the mouth of the mine. The line consists of two stationary sustaining cables, that for the loaded buckets being 1⅛ in. diameter, and the empties returning on a 1-in. cable. An endless ¾-in. steel wire rope is used to propel the buckets and means are provided at the mine end for controlling their speed; also the buckets may be attached and detached to and from the traction cable automatically by clips attached to the cable. The capacity of the bucket is 6½ cu. ft.

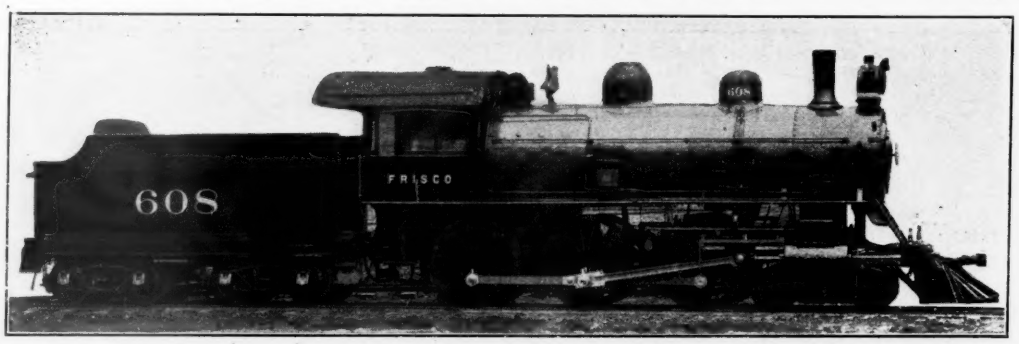
The tramway has an intermediate station about midway of its length from which it is expected to load one from a mine near by, later on. As the snow fall is heavy at this point the terminal and a considerable distance on each side is covered with a snow shed.

The most interesting feature of the tramway is an unsupported span of 2,100 ft. Much of the operation of the system is automatic, requiring comparatively little labor. This same company is now building a tramway of this same type at Encampment, Wyo., which, it is said, will be the longest aerial tramway in the world.

*Mr. Albert O. Crane died at Hoboken, April 10, 1901.

Ten-Wheel Passenger Engine—St. Louis & San Francisco.

The Richmond Works of the American Locomotive Company have recently turned out some 10-wheel simple passenger engines for the 'Frisco line. The feature which first strikes the eye in looking at the illustrations is

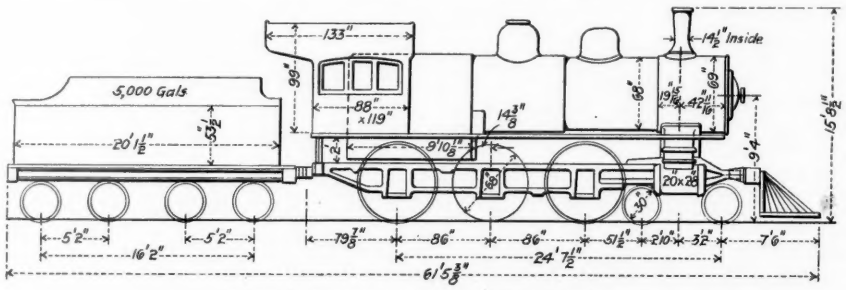


Passenger Engine for the St. Louis & San Francisco with Dav's Counterbalance.

the Davis Counterbalance. Two discs in which the weight is concentrated replace the familiar half-moon which has hitherto held the field. The discs are 19-in. in diameter; extra weight is arranged for in the driving wheel by deepening the hollow in the disc. The diameter of the wheels is 68 in. A detailed cut of the arrangement is shown.

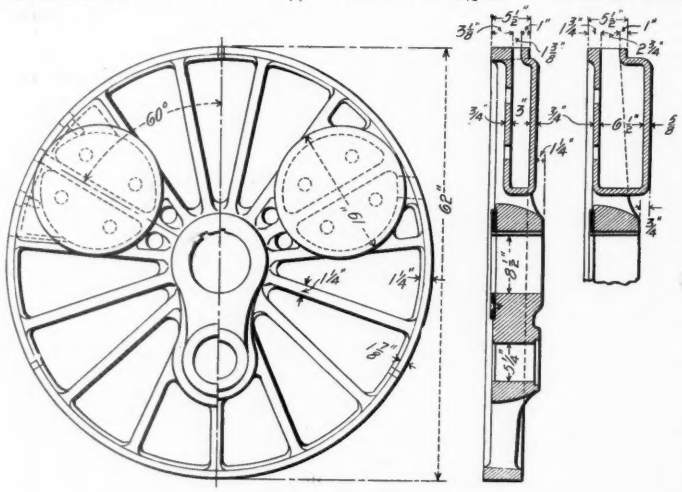
The boiler has a straight top and the crown sheet is radially stayed. The working pressure is 190 lbs. The tender frame consists of 10-in. steel channels, and the coal load is 10½ tons. Tank capacity 5,000 gallons. The steel cab with its large high windows let in plenty of light. A list of the principal dimensions follows:

Gage	4 ft. 8½ in.
Fuel	Bituminous coal
Engine truck, style	Swing bolster
Engine truck wheels, diameter	30 in.
Engine truck wheels, centers	Taylor
Engine truck axle	Hammered iron
Engine truck journals	5½ x 10 in.
Boiler.	
Type	Straight top, radial stayed
Working pressure	190 lbs.
Outside diameter, 1st course	68 in.
Thickness of plates in barrel	⅝ in.
Seams, circumferential	Double riveted
Seams, horizontal	Butt joints, sextuple riveted
Fire-box, length	108⅛ in.
Fire-box, width	40¼ in.
Fire-box, depth	Front, 72½ in.; back, 69½ in.
Fire-box, material	Carbon steel
Fire-box, plates	Sides, ⅜ in.; back, ⅜ in.
Fire-box, plates	Crown, 7/16 in.; tube, ½ in.
Fire-box, water space	Front, 4 in.; side, 4 in.; back, 4 in.
Fire-box, crown stays, diameter	1⅛ in.
Fire-box staybolts, diameter	1 in.
Tubes, material	C. C. iron; length, 14 ft. 0 in.
Tubes	Number, 267; diam., 2¼ in.; thickness, No. 11
Grate, style	Rocking bars, finger type
Exhaust pipe, style	Single
Exhaust pipe nozzle	5¼-5⅝-5½ in.
Smokestack, inside diameter	14½ in.
Smokestack, top above rail	15 ft. 8½ in.
Feed water supplied by	Hancock Composite
Tender.	
Weight, empty	40,000 lbs.
Frame	10-in. channels
Wheels	diam., 36 in.
Journals	5 x 9 in.
Wheel base	16 ft. 2 in.
Tank capacity, water	5,000 gals.
Tank capacity, coal	10½ tons



General Diagram of St. L. & S. F. Engine.

Weight on drivers	120,000 lbs.
Weight in working order	156,000 lbs.
Wheel base, driving	14 ft. 4 in.
Cylinders.	
Diameter	20 in.
Piston stroke	28 in.
Piston packing	Snap rings
Piston rod, diameter	4 in.
Piston rod, material	Hammered iron
Piston rod packing	U. S.
Steam ports	18 x 1⅝ in.
Exhaust ports	18 x 3 in.
Bridge, width	1⅜ in.
Slide Valves.	
Style	Richardson Balanced
Greatest travel	5¾ in.



Details of Davis Counterbalance.

Lap, outside	⅞ in.
Lead in full gear	1/32 in.
Valve stem packing	U. S.
Wheels.	
Driving, diameter	68 in.
Driving, centers, material	Cast steel
Driving, box material	Steeled cast iron
Driving, axle journal	8½ x 10 in. nickel steel
Crank pin, main	Hammered iron case hardened
Crank pins for side rods	Hammered iron case hardened

The Commonwealth Steel Co.'s New Plant.

The new plant which the Commonwealth Steel Co. is building at Granite City, Ill., will, from present indications, be ready for operation by Sept. 1. The buildings cover about eight acres, the property upon which they are located being some 18 acres in extent. The contract for the buildings was let on Feb. 22, and contained the stipulation that they should be completed within seven months, which was practically Oct. 1. By having them ready to start on Sept. 1, means that the entire plant will have been built in six months time. This will be a noteworthy accomplishment and will be the better appreciated when consideration is given to the magnitude of the plant, which will be equipped to turn out 150 tons of steel castings a day, and the difficulty that is experienced in obtaining structural steel.

While the initial capacity of the plant is to be 150 tons per day, the ultimate capacity will exceed this by 100 tons, and it is hoped this latter figure will be reached within the first six months of operation. Three furnaces will be ready for service when the plant starts up. Other furnaces will be added as soon as possible to provide for the increase in capacity mentioned.

It is the intention to have the plant thoroughly modern in every respect, and as it is exclusively for the manufacture of specialties, the equipment throughout will be designed for this purpose. All of the material, from that charged into the furnaces to the finished product, will be handled entirely by machinery, including such operations as charging the furnaces, making molds, pouring, sand-blasting, annealing, finishing and loading. Electric power will be used for the cranes, charging machines, sand-mixers, conveyors and all stationary equipment, while compressed air will operate the various hoists, and the doors of the furnaces.

In the power station steam will be supplied by water tube boilers, equipped with mechanical stokers and modern feed water appliances. The electric generators will be direct-connected to low-speed, double-eccentric Corliss engines. The generating plant, compressed air and elec-

tric, is to be installed in duplicate, and all of the motors for the cranes and power-driven machinery will be of the dust-proof type and will be provided with automatic circuit breakers. Duplicate parts of all machines are to be carried in stock in order to save time in case of repairs.

The furnaces in the open-hearth plant will be what are known as the basic open-hearth type, and are said to be the first of the kind to be used in this country. They will be of a special design adapted to burn fuel oil or gas. The annealing furnaces, upon which much study has been expended, are to be equipped with double-combustion oil burners, which do not require chimneys, the combustion is so nearly complete. It is intended to keep them in continuous operation, with an expert in charge. A laboratory for making chemical and physical tests will be maintained, equipped with all suitable apparatus, and hydraulic testing machines are to be placed in the finishing department for the purpose of testing each important casting before it leaves the works.

So confident is the company that all will be in readiness for starting up on Sept. 1, that orders are being booked on that basis. At the time of our last advice (July 18) the three furnaces were more than half completed, the air compressor and molding cranes had been installed, the engines were in place, and it is expected that one traveling crane will be placed the last week in July.

The Perfection Fuel Economizer and Smoke Consumer

Mention has been made in these columns from time to time of numerous devices and methods for the prevention of smoke with engines burning soft coal. The seriousness of the smoke nuisance is evidenced by the large number of expedients which have been resorted to. Automatic stokers and their substitute, single-shovel firing, arrangements of the fire-box with combustion chambers, brick arches, and air inlets, fire doors of various designs and many other arrangements have been tried with varying success. All, however, are based on the same theory, the prevention of sudden decreases in fire-box temperature and the plentiful supply of oxygen for perfect combustion. With the old methods of firing large quantities of coal were shoveled into the fire-box, blanketing the incandescent bed of coals and for the moment reducing the temperature of the fire-box below the ignition point of the carbon in the coal. The in-rush of cold air when the fire door was opened further decreased the temperature, at the same time inducing a heavy draft through the tubes which drew out the finely divided carbon liberated by the sudden action of heat and the result was large quantities of black smoke emitted through the stack.

Properly constructed fire-boxes with large combustion chambers and careful firing of small quantities of coal at frequent intervals do much toward preventing smoke, but a plentiful and properly adjusted supply of oxygen admitted at a high temperature to the fire-box at the point of maximum passage of the gases of combustion over the arch insures almost complete combustion with a consequent reduction of smoke and increase in available heat units passing through the tubes.

The device here illustrated, the "Perfection" fuel economizer and smoke consumer, has been developed on this theory. Fig. 3, a section through the fire-box, shows the location of the front and back arches with the restricted opening of 17 in. extending the width of the fire-box through which all the gases rising from the grate pass into the combustion chamber and thence to the tubes. The six composition metal tubes shown in end elevation, Fig. 1, project through the rear head just above the back arch and extend into the fire-box flush with the front end of the back arch. These tubes are left bare, being capable of withstanding very high temperatures. The hood B, extending almost across the rear head and 5/8 in. removed from it forms a wide thin passage for the entering air, all of which enters at the top, A, and passes down next to the hot boiler head, attaining a temperature of more than 150 deg. before entering the hot tubes C. In passing through the tubes the air is heated to between 1,100 deg. and 1,500 deg., and is discharged into the gases passing through the arch throat. This addition of oxygen at a high temperature causes the ignition of the gases in the combustion chamber and almost perfect combustion ensues. A blower attachment shown in Fig. 5 and in detail, Fig. 4, is provided to increase the supply of air if desired. Fig. 2 shows in detail the method of inserting the tubes through the back head.

This device after a thorough trial of 11 months is being applied to nearly all of the new engines of the New York Central, and as fast as possible to the old engines. In a test conducted on engine No. 943 of that road under the direction of Mr. Fulton, one of the inventors of the device, the following results were obtained.

Results of Test of Economy Fire Door.
(Hudson Division, New York Central & Hudson River R. R.)

Ordinary Fire Door. Date.	No. of cars.	Lbs. coal consumed.	Lbs. coal per car mile.	Economy Fire Door. Date.	No. of cars.	Lbs. coal consumed.	Lbs. coal per car mile.
Oct. 5..	14½	25,530	12.31	Oct. 19..	16	20,080	8.71
Oct. 7..	12½	22,980	12.90	Oct. 14..	13	14,845	7.99
Oct. 8..	11½	21,980	13.31	Oct. 15..	12½	15,940	8.91
Oct. 9..	13	21,990	11.83	Oct. 16..	12½	18,400	10.22
Oct. 10..	12½	22,510	12.59	Oct. 17..	12½	17,370	9.70
Oct. 11..	12	20,300	11.13	Oct. 18..	11½	19,500	11.86
Oct. 12..	13	21,480	11.55	Oct. 20..	12	18,880	11
Totals.	89	156,770	*12.23	Totals.	90	125,015	*9.77

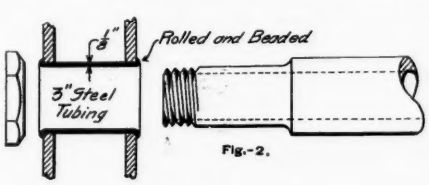
*Average.
Difference in amount of coal used, 15 tons and 1,755 lbs.
A saving of about 20 per cent. (Actual 20.3 per cent.)
By ½ car is meant one car hauled half the distance.

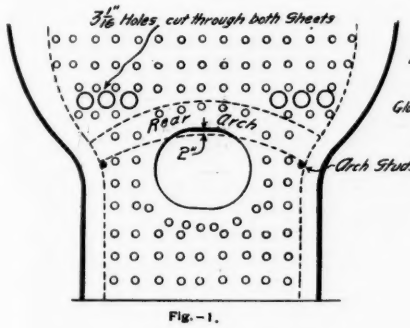
This engine was run by the same engineer and fireman, and drew the same train, before and after the device was applied. Another test which was under the supervision of one of the traveling engineers of the road, and which perhaps more closely approaches conditions of ordinary service with unskilled supervision is given below.

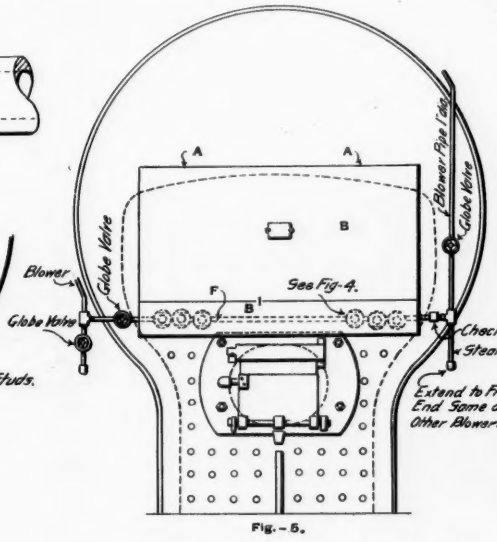
Results of Test of Economy Fire Door.
(Hudson Division, New York Central & Hudson River R. R.)

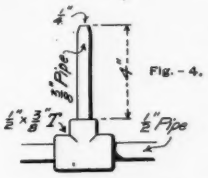
Ordinary Fire Door. Date.	No. of cars.	Lbs. coal consumed.	Lbs. coal per car mile.	Economy Fire Door. Date.	No. of cars.	Lbs. coal consumed.	Lbs. coal per car mile.
Nov. 4..	9	13,940	10.47	Oct. 31..	9	13,400	10.05
Nov. 6..	11	17,250	11.67	Nov. 1..	12	15,650	8.75
Nov. 7..	13	19,310	10.07	Nov. 2..	12	16,150	9.05
Totals.	33	50,500	*10.74	Totals.	33	45,200	*9.28

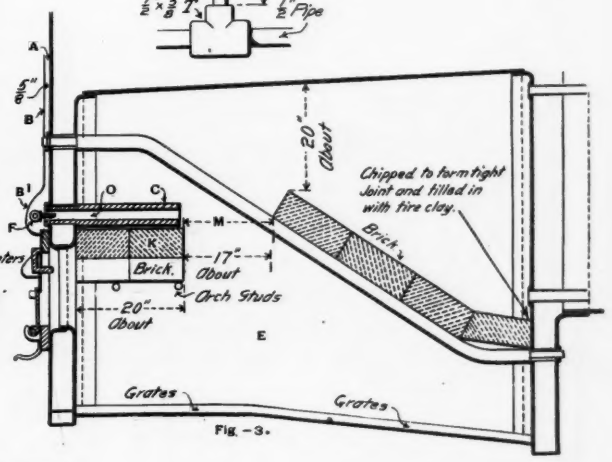
*Average.
Difference in amount of coal consumed, 5,300 lbs.
A saving of 14 per cent.











Perfection Fuel Economizer and Smoke Consumer.

The figures for both tests while varying slightly show conclusively that a considerable saving in fuel is made by the use of the device, and it is stated that it reduces the amount of smoke by at least 75 per cent., and the amount of sparks thrown out from the stack about 90 per cent. It is made and sold by the Coffin-Megeath Supply Co., Franklin, Pa.

Recent Progress in American Bridge Construction.*

BY HENRY S. JACOBY.

. . . The application of scientific principles to the construction of bridges is more complete to-day than ever before. This statement applies to the specified requirements which the finished structure must fulfill, the design of every detail to carry the stresses due to the various loads imposed, the manufacture of the material composing the bridge, the construction of every member in it, and finally the erection of the bridge in the place where it is to do its duty as an instrument of transportation. . . .

Specifications.—The form of loading for bridges almost universally specified by the railroads of this country consists of two consolidation locomotives followed by a uniform train load. These loads are frequently chosen somewhat larger than those that are likely to be actually used for some years in advance, but sometimes the heaviest type of locomotives in use is adopted as the standard loading. The extent to which the specified loadings have changed in eight years may be seen from the following statement based on statistics compiled by Ward Baldwin and published in the *Railroad Gazette* for May 2, 1902.

Of the railroads whose lengths exceed 100 miles, located in the United States, Canada and Mexico, only two out of 77 specified uniform train loads *exceeding* 4,000 lbs. per lineal ft. of track in 1893, while in 1901, only 13 out of 103 railroads specified similar loads *less* than 4,000 lbs. In 1893, 37 railroads specified loads of 3,000 lbs. and 29 of 4,000 lbs., while in 1901, 4,000 lbs. was specified by 50, 4,500 lbs. by 14, and 5,000 lbs. by 17 railroads. The maximum uniform load rose from 4,200 in 1893 to 6,600 lbs. in 1901.

In a similar manner in 1893 only one railroad in 75 specified a load on each driving wheel axle *exceeding* 40,000 lbs., while in 1901 only 13 railroads out of 92 specified *less* than this load. In 1893 only 21 of the 77 railroads specified similar loads exceeding 30,000 lbs. The maximum load on each driving wheel axle rose from 44,000 lbs. in 1893 to 60,000 lbs. in 1901.

The unusual amount of new bridge construction required caused a general revision of the standard specifications for bridges, the effect of which was to include the results of recent studies and experiment, and to eliminate some of the minor and unessential items formerly prescribed.

Meanwhile another movement was in progress. Experience having shown the great advantage of more uniformity in various details and standards relating to the manufacture of bridges both in reducing the cost and the time required for the shop work, an effort was begun to secure more uniformity in the requirements for the production and tests of steel, which is the metal now exclusively employed in bridges.

The American Section of the International Association of Testing Materials is bringing together . . . a mass of selected information on the relations of chemical composition, heat treatment, mechanical work, etc., to the physical properties of steel. . . . The thorough digest of these results of scientific research and practical tests, and the preparation and adoption of standard specifications for different classes of material, are confidently expected to eliminate many old requirements which are proved inefficient in securing the results for which they were originally intended, and to incorporate in the specifications only the essential requirements by which the character of the product may be determined with sufficient precision for its actual duty. By making these requirements reasonable and fair, on the one hand as simple and definite as possible without impairing their real value, and on the other hand flexible enough to avoid imposing undue hardship upon the manufacturer who keeps in touch with the best methods available, the result is confidently expected to be a high degree of interested co-operation on the part of both engineer and manufacturer in securing the best grade of material which the present state of science makes practicable. . . .

With greater uniformity in the physical, chemical and other requirements for steel, as determined by standard tests, the unit stresses to be prescribed for the design of bridges will naturally approach to a corresponding uniformity. To what extent this is desirable may be inferred from the fact that the application of several of the leading specifications to the design of a railroad bridge under a given live load yields results which may vary by an amount ranging from zero to 25 per cent. of the total weight.

In the revision of specifications a decided tendency is observed to simplify the design by making an allowance for impact, vibration, etc., by adding certain percentages to the live load according to some well-defined system. It needs but relatively little experience in making comparative designs of bridges under the same loading, to show the advantage of this method over that in which the allowance is made in the unit stresses according to any of the systems usually adopted in such a case. Not only are the necessary computations greatly

*Address of the Vice-President and Chairman of Section D—Mechanical Science and Engineering—of the American Association for the Advancement of Science, Pittsburgh Meeting, June 28-July 3, 1902. Reprinted from *Science*.

simplified but the same degree of security is obtained in every detail of the connections as in the principal members which compose the structure.

Experiments on a large scale are very much needed to determine the proper percentage of the live load to be allowed for the effect of impact, so as to secure the necessary strength with the least sacrifice of true economy. While the extreme economy of material that was formerly practised is not now desirable, since stiffness receives due consideration, some idea of the importance of such an investigation may be gained by considering the magnitude of the industries involved.

In March, the *Railroad Gazette* published a supplement containing a list of bridge projects under consideration. This list was intended to include only the larger steel and stone structures, whether for railroads or highways, the aim being to exclude those that are obviously unimportant. Besides this, the bridges needed on 1,500 new railroad projects recorded in the same supplement are likewise excluded. After excluding both of these classes the list still contains about 1,300 new projects for bridges.

An investigation might also be advantageously made to determine the proper ratio of the thickness of cover plates in chord members which are subject to compression, to the transverse distance between the connecting lines of rivets. The same need exists in regard to the stiffening of the webs of plate girders, concerning which there is a wide variation in the requirements of different specifications.

Organization.—A movement which has done much good during the past decade and promises more for the future is that of the organization of bridge departments by the railroad companies. The great economy of making one design rather than to ask a number of bridge companies to make an equal number of designs, of which all but one are wasted, is the first advantage; but another of even greater significance in the development of bridge construction is that which arises from the designs being made by those who observe the bridges in the conditions of service and who will naturally devote closer study to every detail than is possible under the former usual conditions. The larger number of responsible designers also leads to the introduction of more new details to be submitted to the test of service, which will indicate those worthy of adoption in later designs. In order to save time and labor and secure greater uniformity in the design of the smaller bridges, some of the railroads prepare standard plans for spans varying by small distances. For the most important structures consulting bridge engineers are more frequently employed than formerly, when so much dependence was placed upon competitive designs made by the bridge companies.

An investigation was recently made by a committee of the Railway Engineering and Maintenance of Way Association in regard to the present practice respecting the degree of completeness of the plans and specifications furnished by the railroads. . . . A large majority of the engineers and bridge companies that responded were in favor of making detail plans.

The shop drawings, which show the form of the bridge, the character and relations of all its parts, give the section and length of every member, and the size and position of every detail whether it be a reinforcing plate, a pin, a bolt, a rivet or a lacing bar. All dimensions on the drawings are checked independently so as to avoid any chance for errors. The systematic manner in which the drawings are made and checked, and the thorough organization of every department of the shops, makes it possible to manufacture the largest bridge, to ship the pieces to a distant site and find on erecting the structure in place that all the parts fit together, although they had not been assembled at the works.

The constant improvement in the equipment of the bridge shops, and the increasing experience of the manufacturers who devote their entire time and attention to the study of better methods for transforming plates, bars, shapes, rivets and pins into bridges, constitute important factors in the development of bridge construction.

Spans and Types of Bridges.—As the length of span for the different classes of bridges gives a general indication of the progress in the science and art of bridge building, the following references are made to the longest existing span for each class, together with the increase in span which has been effected approximately during the past decade.

In plate girder bridges the girders, as their name implies, have solid webs composed of steel plates. A dozen years ago but few plate girders were built whose span exceeded 100 ft., the maximum span being but a few feet longer than this. To-day such large girders are very frequently constructed, and the maximum span has been increased to 126 ft. between centers of bearings. This is the span of the large plate girders of the viaduct on the Riverside Drive in New York City, erected in 1900. The longest railroad plate girder was erected about the same time on the Bradford Division of the Erie Railroad, its span being 125 ft. 2½ in. The heaviest plate girder is the middle one of a four-track bridge on the New York Central Railroad erected last year near Lyons, N. Y. Its weight is 103 tons, its span 107 ft. 8 in., and its depth out to out 12 ft. 2 in.

The large amount of new construction and the corresponding increase in the weight of the rolling stock have combined to secure a more extensive adoption of plate girders and the designs of many new details for them. These affect chiefly the composition of the flanges, the web splices, the expansion bearings and the solid floor system. Although solid metal floors built up of special shapes were first introduced into this country 15 years ago, their general adoption has taken place largely within the past decade on account of their special adaptation to the requirements of the elevation of tracks in cities. Solid floors may not only be made much shallower than the ordinary open type, thereby reducing the total cost of the track elevation, but they also permit the ordinary track construction with cross-ties in ballast to be extended across the bridge, thus avoiding the jar which otherwise results as the train enters and leaves the bridge, unless the track is maintained with extraordinary care.

The necessity for bridges of greater stiffness under the increased live loads has also led to the use of riveted bridges for considerably longer spans than were in use six or seven years ago. The use of pin-connected trusses for spans less than about 150 ft. is undesirable for railroad bridges, on account of the excessive vibration due to the large ratio of the moving load to the dead load, or weight of the bridge itself.

While riveted bridges are now quite generally used for spans from 100 to 150 ft., they have been employed to some extent up to 181½ ft. The recent forms of riveted trusses do not, however, conform to the general character of European designs but embody the distinctively American feature of concentrating the material into fewer members of substantial construction. With but rare exceptions the trusses are of the Warren, Pratt and Baltimore types with single systems of webbing. At a distance where the riveted connections cannot be distinguished, the larger trusses have the same general appearance as the corresponding pin bridges.

The recent examples of viaduct construction with their stiff bracing of built-up members and riveted connections exhibit a marked contrast to the older and lighter structures with their adjustable bracing composed of slender rods. The viaduct which carries the Chicago & North Western across the valley of the Des Moines River, at a height of 185 ft. above the surface of the river is 2,658 ft. long. It was built in 1901, is the longest double-track viaduct in the world, provided those located in cities be excluded, and is an admirable type of the best modern construction. The tower spans are 45 ft. long and the other spans are 75 ft. long. Four lines of plate girders support the two tracks. Along with this viaduct should be mentioned the Viaduct Terminal of the Chesapeake & Ohio Railway at Richmond, Va., whose length, including the depot branch, is 3.13 miles. A large part of this is not very much higher than an elevated railroad in cities. The excellent details and clean lines of this substantial structure give it a character which is surpassed neither in this country nor abroad. It may be added that the highest viaduct in this country, and which was rebuilt in 1900, is located 17 miles from Bradford, Pa., where the Erie Railroad crosses the Kinzua Creek at a height of 301 ft. It has a length of 2,053 ft. . . .

The longest span of any simple truss in America is that of the bridge over the Ohio River at Louisville, erected in 1893. Its span, center to center of end pins, is 546½ ft. Since that time several other bridges of this kind have been built which are considerably heavier, although their spans are somewhat shorter. The most noteworthy of these are the Delaware River bridge on the Pennsylvania Railroad near Philadelphia and the Monongahela River bridge of the Union Railroad at Rankin, Pa., both of which are double-track bridges. The Delaware River bridge was erected in 1896, each one of its fixed spans having a length of 533 ft. and containing 2,094 tons of steel. The Rankin bridge was erected in 1900. Its longer span has a length of 495 ft. 8½ in. between centers of end pins, and contains about 2,800 tons of steel, making it the heaviest single span ever erected. It may also be added that the locomotive and train load for which this bridge was designed is the heaviest that has yet been specified.

The recent changes in the details of pin-connected truss bridges have been mainly the result of efforts to eliminate ambiguity in the stresses of the trusses, to reduce the effect of secondary stresses, and to secure increased stiffness as well as strength in the structure. Double systems of webbing have been practically abandoned so far as new construction is concerned. The simplicity of truss action thus secured permits the stresses to be computed with greater accuracy and thereby tends to economy. Before the last decade very few through bridges and those only of large span were designed with end floor beams in order to make the superstructure as complete as possible in itself and independent of the masonry supports. Now this improved feature is being extended to bridges of small spans. Similarly dropping the ends of all floor beams in through bridges so as to clear the lower chord and to enable the lower lateral system to be connected without producing an excessive bending movement in the posts has likewise been extended to the smaller spans of pin bridges and is now the standard practice. The expansion bearings have been made more effective by the use of larger rollers, and of bed plates so designed as to properly distribute the large loads upon the masonry. In the large spans of through bridges the top chord is curved more uniformly, thereby improving the esthetic appearance. These chords are also given full pin bearings, thus reducing the secondary stresses.

The stiffness of truss bridges has been secured by adopting stiff bracing in the lateral systems and sway bracing, instead of the light adjustable rods formerly used. At the same time adjustable counter ties in the trusses are being replaced in recent years by stiff ones, while in some cases the counters are omitted and the main diagonals designed to take both tension and compression.

Some of the same influences referred to above have led to much simpler designs for the portal bracing by using a few members of adequate strength and stiffness similar in general character to those of the trusses.

Such steady progress in the design and construction of railroad bridges of moderate span has, unfortunately, no adequate counterpart in highway bridges. . . . The lack of proper supervision in the rural districts and many of the smaller cities results in the continued use of short trusses with slender members built up of thin plates and shapes, whose comparatively light weight causes excessive vibration and consequent wear, as well as deterioration from rust. Under better administration plate girders would be substituted for such light trusses, making both a stiffer structure and one more easily protected by paint. . . .

The channel span of the cantilever bridge over the Mississippi River at Memphis, Tenn., is the longest one of any bridge of this class in America. It measures 790½ ft. between centers of supports. This bridge was finished in 1890, the same year that marked the close of the seven-year period of construction and erection of the mammoth cantilever bridge over the Firth of Forth in Scotland. A number of cantilever bridges have been built since then, but most of them have comparatively short spans. There is one now under construction over the Monongahela River in Pittsburgh, and which is expected to be finished this year, whose span is to be a little longer than that of the Memphis bridge. It is on the new extension of the Wabash Railroad system, and the distance between pier centers is 812 ft.

But there is another one being built which will not only have a longer span than any other cantilever bridge in this country, but longer than that of any other bridge whatsoever. It is located near Quebec, Canada, and its channel span over the St. Lawrence River is to have the unprecedented length of 1,800 ft., or nearly a hundred ft. longer than that of the Forth cantilever bridge, and 200 ft. longer than the Brooklyn suspension bridge. The towers will have a height of 360 ft. above high tide. It will accommodate a double-track railroad, besides two electric railroad tracks and highways. In the piers the courses of masonry are 4 ft. high and individual stones weigh about 15 tons each. The character of its design and the simplicity of its details will permit its construction with unusual rapidity and economy for a bridge of this magnitude. Several other cantilever structures whose largest spans range from 600 to 671 ft. are either now or soon will be under construction.

The Brooklyn bridge, completed in 1883, is still the largest suspension bridge in the world, its span being 1,595½ ft. More people cross this bridge than any other in any country. The New East River bridge, which is now being built, has a span of 1,600 ft., and its capacity will be very much greater than that of the Brooklyn bridge. Each of its four cables has a safe strength of over 10,000,000 lbs. in tension.

One of the most interesting developments relating to the subject under consideration is the construction of a considerable number of metallic arch bridges in recent years and the promise of their still greater use in the future. On account of their form they constitute one of the handsomest classes of bridges.

The first important steel bridge in the world was completed in 1874. It is the arch bridge which in three spans crosses the Mississippi River at St. Louis. Its arches are without hinges and their ends are firmly fixed to the piers. This is one of the most famous bridges in existence. For a long time after its construction no metallic arches were erected in this country, although many were built in Europe. In 1888, however, the highway bridge across the Mississippi River at Minneapolis was erected, consisting of two spans of 456 ft. each, and which still remains the longest span of any three-hinged arch. The following year the Washington bridge over the Harlem River in New York City was completed. It consists of two spans of 510 ft. in the clear and has the largest two-hinged arch ribs with solid web plates.

These were followed by a number of arches of various types, the most noted of which are the two arch bridges over the Niagara River. The first one is a spandrel-braced, two-hinged arch with a span of 550 ft., and replaced the Roebling suspension bridge in 1897. It accommodates the two tracks of the Grand Trunk Railway on the upper deck and a highway on the lower deck. The other bridge has arched trusses with parallel chords and two hinges. It replaced the Niagara and Clifton highway suspension bridge in 1898, and as its span is 840 ft., it is the largest arch of any type in the world. The manner in which this arch was erected furnishes an illustration of the effort which is made by engineers to conform the actual conditions so far as possible to the theoretic ones involved in the computation of the stresses. Since the stresses in an arch having less than three hinges are statically indeterminate, stresses of considerable magnitude may be introduced into the trusses if the workmanship be imperfect, the supports not located with sufficient precision, and the arch closed without the proper means and care.

The Niagara & Clifton arch was first closed as a three-hinged arch and then transformed into a two-hinged arch by inserting the final member under the sum of the computed stress due to the weight of the truss, and that due to the difference between the temperature at which the closure was made and that assumed as standard in the stress computations. This stress was secured in the

member by inserting it when the hydraulic jack which forced apart the adjacent ends of the shortened chords registered the required amount of pressure. The arch had been erected at a pair of cantilevers from each side extending 420 ft. out beyond the supports, and when the closure was made the two arms came together within a quarter of an inch of the computed value. Such a result involving the "accuracy of the calculation and design of the entire steel work, the exactness with which the bearing shoes or skewbacks were placed, and the perfection of the shopwork" has been truly characterized as phenomenal. In order to reduce secondary stresses to a minimum the members were bolted up during the cantilever erection and the bolts replaced by rivets after the closure of the arch rib.

The past decade witnessed the introduction and extensive development of arches of concrete and of concrete-steel construction. In the latter kind a small amount of steel is imbedded in the concrete in order to resist any tensile stresses that may be developed. During this period more than 150 concrete steel bridges have been built in this country. In the same year in which the largest metallic arch was completed, the five concrete-steel arches of the bridge at Topeka, Kansas, were finished. The largest one has a span of 125 ft. and still remains the largest span of this type in America, although it has been exceeded in Europe. Considerably larger spans are to be built this season, while others are included in the accepted design for the proposed Memorial bridge at Washington. . . .

Last year a bridge was completed which marks a decided departure from previous practice. The Pennsylvania Railroad built a stone bridge, consisting of 48 segmental arches of 70 ft. span, at the crossing of the Susquehanna River at Rockville, Pa. It is 52 ft. wide, accommodates four tracks and cost a million dollars. This bridge has not only the advantage of almost entirely eliminating the cost of maintenance, but it also has sufficient mass to withstand the floods which occasionally wreck the other bridges on that river. This year the same railroad is building a similar bridge over the Raritan River at New Brunswick, N. J.

Of movable bridges the largest swing span existing was erected in 1893 at Omaha over the Missouri River. Two years later a four-track railroad swing bridge was built by the New York Central Railroad over the Harlem River in New York City, which is only 359 ft. long between centers of end pins, but which weighs about 2,500 tons, and is accordingly the heaviest drawbridge of any class in the world.

During the past decade a remarkable development was made in drawbridge construction by the modification and improvement of some of the older types of lift bridges and the design of several new types. At South Halsted street a direct-lift bridge was built in 1893 over the Chicago River, in which a simple span 130 ft. long and 50 ft. wide is lifted vertically 142½ ft. by means of cables to which counterweights are attached. Formerly, only very small bridges of this kind were used, as those, for instance, over the Erie Canal.

In 1895 a rolling lift bridge over the Chicago River was completed. In this new design as each leaf of the bridge rotates to a vertical position it rolls backward at one end. When closed the two leaves are locked at the center, but they are supported as cantilevers. This form has been found to have so many advantages for the crossings of relatively narrow streams, where an unobstructed water way is required and the adjacent shores are needed for dock room, that a score of important structures of this class have been built in different cities. The largest span that has been designed is 275 ft. between centers of supports, while the widest one is to accommodate eight railroad tracks crossing the Chicago Main Drainage Canal.

About the same time and under similar conditions another type of bascule bridge was built at Sixteenth street, Milwaukee, in which, as each leaf moves toward the shore, one end rises and the other falls, so that its center of gravity moves horizontally, thus requiring a very small expenditure of power to operate the bridge.

Several improved forms of hinged-lift bridges have also been designed and built in Chicago and elsewhere. In a small bridge erected in 1896 on the Erie Railroad in the Hackensack meadows there is only a single leaf hinged at one end and lifted by a cable attached to the other end. The counterweight rolls on a curved track so designed as to make the counterbalance equally effective in all stages of opening and closing the bridge.

A novel bridge is now being built over the ship canal at Duluth which is different from any other type in this country. [See *Railroad Gazette*, March 14, 1902, p. 177.]

A bridge is being built across the Charles River between Boston and Cambridge that deserves especial mention and marks a decided advance in the growing recognition on the part of municipal authorities of the importance of esthetic considerations in the design of public works. It consists of 11 spans of steel arches whose lengths range from 101½ to 188½ ft. Its width is 105 ft. between railings. It is claimed that this bridge "will be not only one of the finest structures of its kind in this country, but will be a rival of any in the old world." Its length between abutments is 1,767½ ft., and it is estimated to cost about two and a half millions of dollars.

The problems incident to the replacing and strengthening of old bridges frequently tax the resources of the engineer and demonstrate his ability to overcome difficulties. Only a few examples will be cited to indicate the character of this work. In 1900 the Niagara cantilever bridge had its capacity increased about 75 per cent. by the insertion of a middle truss without interfering with traffic. In 1897 the entire floor of the Cincinnati and Covington suspension bridge was raised 4 ft. while the traffic was using it. It may be of interest to state that the two new cables, 10½ in. in diameter, which were added to increase the capacity of the bridge, have just about three times the strength of the two old ones, 12⅛ in. in diameter, and which were made a little over 30 years before. In the same year the old tubular bridge across the St. Lawrence River was replaced by simple truss spans without the use of false works under the bridge and without interfering with traffic. On May 25 of this year the Pennsylvania Railroad bridge over the Raritan River and canal at New Brunswick, N. J., was moved sidewise a distance of 14½ ft. Five simple spans 150 ft. long and a drawbridge of the same length, weighing in all 2,057 tons, were moved to the new position and aligned in 2 minutes and 50 seconds. The actual time that the two tracks were out of service were respectively 15 and 28 minutes. On Oct. 17, 1897, on the same railroad near Girard avenue, Philadelphia, an old span was moved away and a new one, 235 ft. 7 in. long, put in exactly the same place in 2 minutes and 28 seconds. No train was delayed in either case.

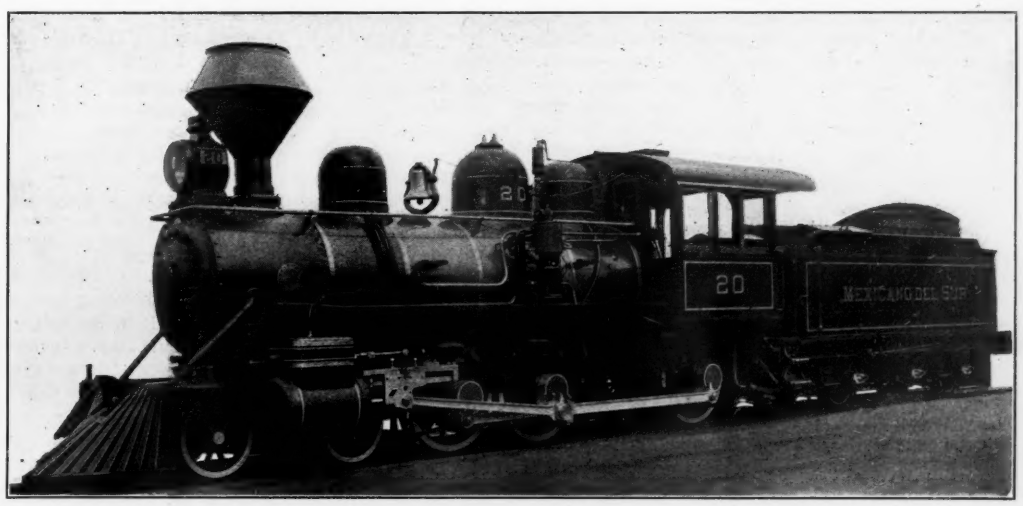
A Large Narrow Gage Locomotive.

The Cooke Works of the American Locomotive Company has just built for the Mexican Southern, two unusually large narrow gage locomotives. One of these is a consolidation and the other a 10-wheeler. The latter is illustrated by the accompanying engraving.

The narrow gage (3 ft.) called for several special features in the design. The frames are placed on the outside of the drivers and the cranks consist of separate pieces shrunk on the axles. The smoke-box is of the extended type with netting in the stack.

We give below some of the leading dimensions for the 10-wheeler.

Description.	
Weight on drivers	58,000 lbs.
Weight on truck wheels	29,000 lbs.
Weight, total	87,000 lbs.
Weight, tender loaded	67,000 lbs.
General Dimensions.	
Wheel base, total, of engine	22 ft. 1 in.
Wheel base, driving	13 ft. 2 in.
Wheel base, total (engine and tender)	42 ft. 7 in.
Height, center of boiler above rails	6 ft. ½ in.



Narrow Gage Locomotive for the Mexican Southern.
Built by the COOKE WORKS, AMERICAN LOCOMOTIVE CO., *Paterson, N. J.*

Height of stack	13 ft. 9 in.
Heating surface, fire-box	77 sq. ft.
Heating surface, tubes	977 sq. ft.
Heating surface, total	1,054 sq. ft.
Grate area	15.4 sq. ft.
Wheels and Journals.	
Drivers, diameter	47 in.
Drivers, material of centers	Cast steel
Truck wheels, diameter	30 in.
Journals, driving axle, size	7 x 7 in.
Journals, truck axle, size	4¾ x 7 in.
Cylinders.	
Cylinders, diameter	17 in.
Piston, stroke	20 in.
Steam ports, length	14 in.
Steam ports, width	1¼ in.
Exhaust ports, length	14 in.
Exhaust ports, width	2½ in.
Valves.	
Valves, kind of	Richardson, balanced
Valves, greatest travel	5½ in.
Valves, outside lap	¾ in.
Valves, inside lap or clearance	0 in.
Boiler.	
Boiler, type of	Straight top
Boiler, working steam pressure	160 lbs.
Boiler, thickness of material in barrel	9/16 in.
Boiler, diameter of barrel	52⅝ in.
Crown sheet stayed with	Radial stays
Fire-box.	
Fire-box, length	3 ft. 13 3/16 in.
Fire-box, width	3 ft. 8⅞ in.
Grate, kind of	Rocking
Tubes.	
Tubes, number	134
Tubes, outside diameter	2¼ in.
Tubes, length over sheets	11 ft. 7 in.
Miscellaneous.	
Netting	Wire, 5 mesh, placed in stack
Stack	Diamond
Tender.	
Tank capacity for water	3,000 gal.
Coal capacity	5 tons
Type of under-frame	8-in. steel channel
Type of truck	Arch bar, combination bolster
Diameter of truck wheels	30-in. cast steel center
Diameter and length of axle journals	3¾ x 7 in.

Anniversary of the Mallet Compound Locomotive.

A small pamphlet, announcing the 25th anniversary of the compound locomotive has been lately issued by Mr. A. Mallet (30 Avenue Trudaine, Paris), who was the first to successfully apply the compound principle to locomotive service.

The first regular running of his compounds took place concurrently with the opening of the standard gage railroad between Bayonne and Biarritz on June 2, 1877. (*Railroad Gazette*, Dec. 21, 1877.) These engines were made in 1876 at the Creusot Works and were of the two cylinder compound type with starting arrangement for the admission of high pressure steam to the low pressure cylinder.

Notwithstanding strenuous opposition, the compound has rapidly gained favor especially within the last few years. Mr. Mallet says that up to 1889 the total number of compounds was 1,000, and now, after 25 years, there are about 15,000 in use. Of this number about 10,000 are of the type brought out in 1876, which he introduced into Russia, Spain, Austria and Switzerland. Out of this total more than 500 engines belong to the four-cylinder articulated type designed by Mr. Mallet and used on the Paris Exhibition Railroad in 1889.

During 1877 the construction was begun of a new system of compound locomotives provided with an arrangement for varying separately and according to requirements, the admission of steam into the two cylinders. In 1877 the Fourneyron prize for mechanical advance was bestowed upon Mr. Mallet in recognition of his initiative in the application of the compound system to locomotives.

Hot Weather Railroad Traveling.

Dr. E. Jung, of Leipsic, in an article on the railroads of British India, published in the *Journal* of the German Railroad Union, says: "The Indian passenger cars afford unexcelled comfort, and for small charges. A first-class car has only four seats (he probably means a first-class compartment), and when three friends are in one compartment, they can be sure that they will be left alone and undisturbed. The four seats can be converted at will into four couches; and there are curtains on the outside, and blue window blinds, to protect the eyes from the dazzling rays of the tropical sun. All the cars are painted white, protected from the sun by a projecting roof, and have a double roof, between which in summer a current of cool water flows. The passenger can pass from his compartment into a bath-room, where he may wash or have a refreshing shower bath. Charges for baggage are very high, but a first-class passenger can take practically as much as he pleases free."

It should be remembered, when considering these hot-weather luxuries, that only an insignificant fraction of the passengers on the Indian railroads travel first-class. Dr. Jung continues: "On the plains of Northern India in the hot season, all traveling should be done by night. A journey by day is a foolhardy undertaking which every year costs several Europeans their lives, in spite of the box of ice which they usually take with them. In the first-class cars the four berths are hung along the windows; the passengers carry their own bedclothes with them, and their beds are made by a servant who travels third-class. In the hot season, in the two front windows are hung two mats, which are immersed half way in a trough of water and slowly revolved. Through the wet upper half of these mats comes the wind, and so cooled fans the burning faces of the passengers. All the other windows, of course, remain open. In spite of this, a railroad journey in an Indian summer night is no treat. When the train halts at stations, especially, the passenger misses the cool draft through the wet mats caused by the motion of the train. Then the heat becomes almost insufferable, and the punkah, or native fan, which in houses is in motion from March till the end of October, is sadly missed."

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

Never, since Christopher Columbus discovered America, have so many freight cars been at home. A recent journey of about 2,000 miles, mostly by daylight, over two trunk lines, showed strings of cars, which made one think of the hard times of 1894. But it was amazing to see how few foreign cars were included in these trains. It was interesting also to observe the acute sensitiveness of the superintendent of transportation to the sight of the initials of a foreign road. No such job of house cleaning has been done on the railroads of the United States for many years. It must follow that greater use will be got out of the freight stock, and car builders have a good deal of apprehension that a corollary of this will be a diminution in the activity of car building. It would not be surprising if this were true, but, on the other hand, many railroads are now running cars which they cannot afford to run because the capacity is too low. Light-weight cars will be condemned and broken up and replaced by heavy cars, and this movement will, in some degree, offset the lessened demand for cars following on their better distribution and more active use.

Rapid Transit Extension in New York.

The late Collis P. Huntington is supposed to have said (and he might well have said) that he was the most patient institution on earth except the Catholic Church. The value of patience in human affairs is illustrated in the working out of the scheme of rapid transit in New York City. A scheme fairly comprehensive at the start has been slowly developed through many vicissitudes. It has been changed, it has been curtailed, it has been variously modified; but the pertinacity, the patience and the tact of a few men have carried the scheme forward, until now it seems as if something will work out more comprehensive than was seriously thought of ten years ago.

The result is likely to give a demonstration of the practical wisdom underlying the form and composition of the present Board of Rapid Transit Commissioners, and we question very seriously the wisdom of making any such change in the composition of this Board as has been recently suggested in some of the newspapers. All that, however, we may consider at some other time.

Last Monday occurred an important episode in the life of this Board and in the development of rapid transit in New York City. That was the opening of the bids for continuing the line of the subway to the foot of Broadway, across the East River, and out through Brooklyn to the junction of Atlantic avenue and Flatbush avenue. Two bidders appeared with three bids. The Brooklyn Rapid Transit Company offered to build and equip the new line for $7,000,000, and $1,000,000 more for real estate and terminals, this latter being the amount estimated by the Board of Rapid Transit Commissioners. The Rapid Transit Subway Construction Company, through its President, Mr. August Belmont, offered to build the new road for $2,000,000, and $1,000,000 more for real estate and terminals, or for $3,000,000 (plus $1,000,000), provided they should receive a contract to build along Broadway from Union Square to Forty-second street, this for the nominal sum of $100,000.

Of course, there are certain other differences in the propositions of the two bidders in the way of agreement to give transfers and to make long hauls for one fare, but those are not controlling factors or very important factors. The fact remains that there is a difference of $5,000,000 to be accounted for between the two bidders. The further fact is that the bid of the Brooklyn Rapid Transit Company is somewhat less than the estimate of the Rapid Transit Commissioners; thus it is obvious that the Rapid Transit Subway Construction Company is paying at least $5,000,000 for the franchise to extend and operate the new line from the Post Office in New York to Atlantic avenue and Flatbush avenue in Brooklyn. We are justified probably in guessing that the contract will be awarded to Mr. Belmont's company, but we are obliged to write before the award is made.

This new contract is the working out and extension of the original idea of the Rapid Transit Commissioners. It was long ago expected to carry the road to the foot of Broadway, and it was expected to carry the road up Broadway from Union Square. These two important parts of the earlier scheme were left out because of the necessity of reducing the cost, in consideration of the debt limit of the city. It is fortunate now that these provisions can be restored. The extension into Brooklyn is logical and inevitable, and is a part of that systematic development of which we spoke earlier in this article.

Concerning the next step of which the public is likely to hear, we need venture no conjecture now, but there is little doubt that as the scheme unfolds itself the people of the city will find that they are to be accommodated with rapid transit facilities even beyond what they have ventured to hope for.

The Pennsylvania Railroad in New York.

On Tuesday of this week the Aldermen of the City of New York voted by 56 to 10 against granting the franchise to the Pennsylvania Railroad Company for building its tunnel railroad across the city. This is a serious misfortune to the City of New York, but we may hope that the objections of the Aldermen may be shortly overcome and the franchise granted. The reasons brought forward are not very weighty. The Committee on Railroads gave the following:

Pipe galleries are not provided for.—But the Pennsylvania Railroad tunnel is from 45 ft. to 60 ft. below the surface of Manhattan Island. Admitting that it is desirable to carry pipe galleries along the line of that tunnel, admitting that it would serve public uses to concentrate pipes in galleries having that geographical position, they would be too deep below the surface to be available and practicable. In the subway tunnel building for the city at this moment it was not thought expedient to introduce pipe galleries, although this is a shallow tunnel. Furthermore, the city would have no right to ask for space in the Pennsylvania tunnel, inasmuch as it is already paid for this franchise under the compensation clause.

No time limit is fixed for the construction.—It is obvious that if the Pennsylvania Railroad builds the tunnel at all it will do that work as promptly as is practicable. Expedition in this matter is self interest. Money invested must be made productive as soon as possible. The longer the delay the greater the interest account.

There is no provision for the employment of union labor at the prevailing rate of wages.—This is a popular objection to raise. It answers the double purpose of a bid for the labor vote and of helping to obstruct. But it is not in the province of the city to make conditions as to wages and hours, for the work is to be entirely that of a private railroad company, and not in any sense a city work. Presumably an attempt to place such a restriction upon the company or contractor would be illegal and unconstitutional.

Other objections were brought forward in the debate in the Board, as for instance:

The real intentions of the railroad company are not known.—How can an Alderman, or anybody else, ever be sure that he actually knows the real intentions of the company, or of any company, or of any man? We may impute to anybody any motives that we choose; of their probability we must judge in the light of experience with that company or that man. In the negotiations forwarding this matter the Pennsylvania has been candid almost beyond precedent. It is hardly extravagant to say that the company has introduced a new theory of negotiations of this sort, by the courage and candor with which it has made its purposes known. In this statement the various officers and boards representing the city must bear us out, if they speak the truth.

The compensation is not sufficient.—One speaker said that it is $75,000 a year. The compensation will amount to about 2½ million dollars the first twenty-five years. It is based on the theory that everything that the railroad obtains is to be paid for. It is a heavy burden on the probable traffic, and a considerably heavier rental would probably destroy the whole plan.

It was said that the Rapid Transit Commission is a self-perpetuating body.—This objection appears to be irrelevant.

It is said that the franchise creates a monopoly.—This is untrue on its face. Any other railroad may ask for the same kind of a franchise, and probably will get it, if it shows good faith and a reasonable project.

The franchise is said to be perpetual.—This is not correct in the ordinary sense. It is a twenty-five-year franchise, adjustable every twenty-five years, under terms that must be satisfactory to the city.

Beyond these, one of the morning newspapers has raised several objections, for instance:

The city officials will have no control over the construction and operation of the tunnel.—There appears to be no reason why they should have control. This it not a public enterprise, and no passengers are to be handled between local points in the city.

The Pennsylvania Railroad may be seeking to draw commerce away from New York city.—It hardly seems worth while to reply to such an objection. It is the aim of the Pennsylvania Railroad to increase commerce in New York City in every way it can. This, in fact, is one of the essentials to the continued prosperity of the Pennsylvania Railroad. Somebody has suggested that this tunnel route may mean the transfer of the Pennsylvania freight terminal to Montauk Point. This notion was long ago exploded. No man of information has considered it seriously for years.

The construction of the tunnel would interfere with a west-side extension of the Rapid Transit Subway.—This we do not understand, but, at any rate, the profile which was approved by the Rapid Transit Commission would not interfere with the subway down any one of the north and south streets of New York City. Surely the Rapid Transit Commission has been jealous in safeguarding this class of the municipal interests of New York.

As we said above, it would be a great misfortune to the City of New York if this project were seriously retarded. The Pennsylvania Railroad Company has laid out a scheme which will be of vast importance to the passenger movement and to the industrial and commercial development of the cities of New York and Brooklyn, and the whole course of advancing this scheme has been marked by evidence of good faith and liberality.

Orders have been issued to trainmen of the Pittsburgh Division of the Pennsylvania Railroad to request passengers to either place their hand luggage out of the aisles of the cars or to have it checked and put in the baggage cars. The order has created a great deal of talk among the trainmen and passengers. The passengers claim that the company should equip cars with continuous racks or otherwise provide for hand luggage. They contend that entirely too much time would be lost in checking the baggage and that the hand pieces would not receive the proper attention at the hands of the "baggage smasher." The order is said to have been inspired by numerous kicks from passengers to the effect that the aisles were overcrowded with luggage and that one could not move through the cars without stumbling over the impedimenta.—*Pittsburgh Dispatch.*

Continuous racks, or continual kicks; this appears to be the alternative, according to the Pittsburgh reporter. Whether or not passengers do actually put in words and communicate to the railroad superintendent many complaints about obstructions in aisles may be questioned; for the reporter evidently has not seen and counted the complaints, and passengers are likely to submit to a good deal of inconvenience of this kind without any stronger protest than an inward growl. But the difficulty is a constant one and, with the universal use of the "suit case," appears to be growing. Every one who goes through a full car in a dark train shed does a lot of involuntary kicking with his feet, whether he does or does not do any with his pen, or orally. But what can the passenger do? Of course, he cannot have his hand baggage checked, especially if he is going to or from a large terminal where, on busy days in summer, the checking or claiming of a single piece often consumes a long time. The unobtrusive passenger who tries to put even a small suit case in front of his knees, or under his legs, or close to the side of the car, is to be commended for his regard for the rights of his fellows, but is to be commiserated nevertheless; for it is out of the question to make such disposal of your baggage and still be comfortable. Even

if you could put the baggage partly or wholly under the seat, that is a first rate method of inducing yourself to forget it when you leave the car, and therefore is objectionable in many cases. The continuous rack is the best relief available at present, but it is of little value to women or to persons of small stature. Not many roads have continuous racks and some even think that in local trains no racks at all are necessary. We are at a loss to understand this. Continuous racks are a constant convenience, even on suburban trains, as the writer knows from experience. Even for such small things as hats and umbrellas the rack is better than any other device, and a continuous rack costs little, if any, more than a succession of 5-ft. racks. An improvement needed in some cars recently built is the widening of the racks; they are hardly a safe place for a full-size suit case, for its center of gravity comes too near the edge of the rack. For the woman with a suit case somebody ought to design a seat with a recess at the end, next the aisle, high enough to permit the case to be put beneath the seat. The case should be put in the aisle, as now, but should project into the aisle only two or three inches; just enough to cause the owner to stumble over it when going out, but not enough to exasperate other passengers.

NEW PUBLICATIONS.

The Science of Mechanics. By Dr. Ernst Mach. Translated from the German by Thomas J. McCormack. Second revised and enlarged edition. Chicago: Open Court Publishing Company, 1902. Octavo, 605 pages. Price $2.00.

This interesting work is a critical examination of the principles of mechanics, largely from the historical point of view. Beginning with Archimedes, the development of mechanical principles and theories is traced from the simple law of the lever to the comprehensive law of conservation of energy established in the nineteenth century. The points of view under which Galileo, Huygens, and Newton developed and formulated the methods of dynamics are set forth in a clear and instructive manner, and their fundamental bases are shown to rest, not on logic, but on experience. Knowledge of the operations of nature gained through experience is called instinctive, and no mathematical demonstrations can prove its correctness. The mania for demonstration, so prevalent in the schools, is severely criticised, and it is maintained that the fundamental principles and methods of mechanics should be instinctively perceived or discerned by the student rather than be justified by mathematical logic.

This view of the author will be regarded with favor, we think, by many American engineers. It is not uncommon, in fact, that engineers, machinists, and even common workmen have clear and precise notions of the parallelogram of forces, the principle of moments, and the conservation of energy, and are able to apply this instinctive knowledge with success, and yet are very deficient in mathematical ability. It is not doubted but that the capacities of such men would be greatly increased by adding mathematical training to their instinctive knowledge, but such training given to youths without the mechanical instinct cannot be productive of the best results. Hence it is that laboratory work is now recognized as of great importance in all departments of technical instruction.

The first edition of Dr. Mach's book was published in 1883, and the fourth in 1901. The present issue of the English translation includes the changes and additions made in the fourth German edition, which mainly consist of 70 additional pages giving the replies made by Dr. Mach to his reviewers and critics. On the whole the views of the author have been widely accepted in Continental Europe, unless it be in regard to certain psychological and metaphysical principles. In regard to the translation we have but one criticism to make, namely, that the old term vis viva should not have been used, and that the modern terms kinetic and potential energy should have been more generally employed. It is with pleasure that we commend the book as one worthy of the careful attention of all teachers and engineers who desire to know of the history of the development of mechanics or to thoroughly understand the reasons for the truth of its fundamental principles.

The Mechanics of Engineering. Vol. II. By A. Jay DuBois, Professor of Civil Engineering in the Sheffield Scientific School of Yale University. New York: John Wiley & Sons, 1902. Quarto, xxiii + 609 pages, with 28 plates.

A notice of Vol. I of this work will be found in our issue of March 14, 1902 (page 193). The first volume is bound in blue and the second in brown, thus clearly distinguishing the theoretical from the practical as they stand upon the shelf, for Vol. I treats of theoretical mechanics mainly, while Vol. II. treats of framed structures, materials and the designing of bridges. Vol. II. is, in fact, the twelfth edition of the author's well-known "Stresses in Framed Structures," a review of the tenth edition of which was given in our issue of April 2, 1897 (page 245). The present edition contains a new treatment of the continuous girder, of the swing bridge, and of the braced arch, as also a new chapter on the stone arch which is treated as elastic instead of rigid as is ordinarily done. Some of this matter is found in both Vol. I and Vol. II; for instance, the chapters on long columns, the metal arch, the stone arch, and composite structures are common to both volumes, thus bringing these new discussions to the notice of both theoretical and practical men.

The author's new treatment of the continuous girder consists in deducing the theorem of three moments for a truss of varying cross-section. For swing bridges a method of finding the reactions for such cases has long been in use, but the author's formulæ render it now possible to easily extend the process to any number of spans. In the practical part of the volume few changes have been made. Cooper's specifications of 1896 for steel bridges are given, and no note is made that those of 1901 contain many new points. Working drawings of a wrought-iron bridge, built by Kellogg and Maurice in 1882, are presented, and the method of designing it according to Cooper's specifications for steel bridges is explained, except that different live loads and working stresses are used. Probably some teachers may think that this bridge serves to illustrate principles and methods just as well as a modern structure, but few engineers will agree with such an opinion.

Hand-Book of Railroad Securities. July, 1902. Description, income, prices, dividends. Compiled by the *Commercial and Financial Chronicle.* New York: William B. Dana Co., publishers. $1.

This little volume gives, first, a table of railroad securities and then a table of industrial securities. These tables give amount outstanding, rate per year, dividend periods, miles operated, gross receipts, net profits and some general information as to the course of dividends, change of ownership, etc. Another table gives the highest and lowest prices monthly and yearly, monthly from the beginning of 1901 to July, 1902, and yearly from 1896. This is for the New York Stock Exchange, but quotations on the stock exchanges of Boston and Philadelphia are given by months for the first half of 1902. Still another table gives the highest and lowest price each year with the date thereof for the last three years and half of the current year. Finally, there are tables giving the dividends paid on railroad stocks and on the leading industrial stocks from 1896. The reader will see at once that this is a reference book which is likely to be of considerable use.

The Municipal Year Book. 1902. Giving population, assessed valuation, etc., etc., for all incorporated towns in the United States, with summaries and editorial discussions. Edited by M. N. Baker, Ph. B., C. E., Associate Editor of *Engineering News.* New York: Engineering News Publishing Co. $3.

The scope of this book is fairly well indicated by the title. It is an octavo volume of 310 pages. The arrangement of information is by States, the States being arranged alphabetically under their respective geographical groups. In each State the towns appear alphabetically. Opening at random we take Altoona, Pa. We find the population, the assessed valuation, the officers of the city, the public utilities owned by the city, with officers in charge, and those owned by private companies. The character of the water supply is mentioned, the arrangement for sewerage, for street cleaning, for street sprinkling, garbage collecting, fire department and electric wires are also briefly described. All of this is in a paragraph of two or three inches. This gives a sufficient indication of the character of the body of the book. There are also a number of convenient tables, grouping information which may be sought by sanitary engineers or students of municipal and sanitary matters. These tables collect into more available form the information given in the body of the work.

Notes on the Construction and Working of Pumps. By Edward C. R. Marks, M. Inst. M. E., Manchester, England; The Technical Publishing Co., Ltd.; 187 pages, 4½ x 7 in. Price 3s. 6d.

The earlier chapters of this little volume deal with matters common to all pumps, such as the limit of suction, lift, speed of piston, etc. The remaining chapters contain well classified descriptions of the various types of pumps and pumping machinery. The matter is not original but appears to have been drawn largely from current trade catalogues. The book is of some use to engineers or manufacturers who have to decide upon the proper type of pump for a given service.

Cassier's Magazine for July is a mining and metallurgical number. It is a handsome volume of 254 pages, to say nothing of about an equal number of pages of advertisements. The papers cover gold mining in South Africa, hydraulic mining, the steel trade in England, copper in the United States, gold dredging in New Zealand, steel in Canada and coal-cutting machinery. These papers are by several distinguished gentlemen, including Mr. John Hays Hammond and Mr. J. J. Moxham.

TRADE CATALOGUES.

S. K. C. Bulletin No. 127, headed "Switches," 32 pages, of the Stanley Electric Manufacturing Company, is ready for distribution. Besides the well-known type of S. K. C. slide switches, carbon break switches, etc., many specialties are included, among which are a combined oil switch and circuit breaker for great capacities at high voltage and a line of knife switches, the blades of which are made up of units, providing a range in capacity from 50 to 3,000 amperes, single or double throw, with or without fuses and with or without quick break. Copies may be had from Ray D. Lillibridge, 170 Broadway, New York.

The Railway Appliances Co., Old Colony Building, Chicago, sends a little pamphlet describing a number of its well-known specialties. These include an emergency knuckle, a car replacer, an auxiliary coupler, metal packing, etc.

The Overland Limited.—The Chicago & North Western has issued an attractive little pamphlet devoted to a description of this handsome train, with half-tone illustrations and also having engravings from photographs of interesting scenery. In the back are diagrams of the various cars of the train.

Vulcan Iron Works, Chicago, Ill., in their catalogue No. 22 describe and illustrate three styles of car pile drivers: No. 1, the latest and heaviest design, is self-propelling, has an all steel superstructure and weighs 87,100 lbs.; No. 2 is not self-propelling but is arranged to drive from either end, drives 20-ft. bents and has 40 ft. headers. No. 3, an older but cheaper style, is made entirely of wood and drives from one end only.

The 1902 catalogue of the Buda Foundry & Manufacturing Co., Harvey, Ill., is in convenient and serviceable form. It is filled with illustrations, mostly half-tone engravings, of the great variety of railroad and contractors' supplies made by this company and in the back are a number of pages of useful information, convenient for ready reference.

Notes for Travelers Over the Siberian Railroad.*

Trains can be taken at Vladivostock, Dalny, Port Arthur, or Niuchwang daily for St. Petersburg, all rail except 27 miles across Lake Baikal.

At present, only second-class accommodations can be had from the Pacific to Irkutsk. First-class trains are expected to cover the entire route in a short time. Station eating houses are plentiful along the route, but a good lunch basket will be found advantageous.

From Irkutsk, three fast trains per week are run to St. Petersburg. These are fitted up with dining cars, bath, barber shop, and library. Slower trains run daily. The time from Irkutsk to St. Petersburg on fast trains is eight days. It is advisable to engage compartments or seats on the train a day in advance of leaving. Blankets, pillows, towels and soap should be carried by travelers.

Baggage.—Baggage to the amount of 36 lbs. is carried free, and all above that going into the luggage car is charged for. It is therefore advisable to have as much hand baggage as possible.

Fare.—A first-class fare from Irkutsk to St. Petersburg will not exceed 121.50 rubles ($62.54); second-class, 90.90 rubles ($46.81). Sleeping car from Irkutsk to St. Petersburg, first-class, 22.52 rubles ($11.60); second-class, 14.32 rubles ($7.37).

Time.—From Japan or China to New York via Siberia, the time required and cost of trip are about the same as across the Pacific and the American Continent. Travelers from London have been arriving at Niuchwang in 20 days.

Language.—Persons not able to speak the Russian language should have a small dictionary in their native tongue and Russian, or at least a book containing the words used for food, drink, and common requirements. Only Russian is spoken by trainmen.

Money.—Money, after leaving the Pacific should be all in rubles and kopecks. One ruble is about equal in value to 50 cents gold and 1 kopeck to 0.5 cent gold. Money can be exchanged at the banks at Vladivostock, Dalny, Port Arthur, or Niuchwang.

Passports.—Passports, visaed by a Russian consul, are required.

Connections.—Trains from Pekin and Tientsin make close daily connection with trains for St. Petersburg at Niuchwang; time from Pekin to Niuchwang, two days. Several steam lines run from Japan, Shanghai and Chefoo to Vladivostock, Port Arthur, Dalny, Niuchwang and Tientsin.

Hotels.—The best hotels are at Dalny and Niuchwang, and these are only fair. Port Arthur has as yet no hotel accommodations, and it is advisable to remain on the steamer until leaving by train.

Consuls.—There is a consul of the United States at Niuchwang, and a United States commercial agent at Vladivostock. The United States has no representative at Dalny or Port Arthur, or at any other point in Manchuria or Siberia.

Telegrams.—Telegrams can be sent to London and points in Europe for 59 kopecks (30.3 cents) per word, and to New York for 98 kopecks (50.4 cents) per word. Telegraph rates to all points in Russia are 15 kopecks (7.7 cents) per message [length not stated], and 10 kopecks (5.1 cents) per word additional.

Addition to the Illinois Central Station at Chicago.

An addition is being built to the main passenger station of the Illinois Central in Chicago, which is also the general office building of the company, to provide needed office room, the present quarters being crowded. The new part is on the west side of the present structure and fronts on Twelfth street 100 ft. It is 60 ft. the other way, is to be 10 stories high, and architecturally it will harmonize with the main building.

What offices or departments will be moved into it has not yet been decided. It is probable that there will be an entire rearrangemnt of the present offices when the new part is completed in order to afford more room to each department, and from $25,000 to $50,000 may be expended in this way. The steel frame work of the new

*From a United States Consular Report by Henry B. Miller, Niuchwang.

structure is at present being erected, and it is expected to have the building ready for occupancy by January 1. The estimated cost of the work is $225,000.

Valve Gear for Four-Cylinder Balanced Compound Locomotives—Von Borries' Patent.*

The accompanying illustrations and description of Mr. A. Von Borries' cylinder and valve arrangements for four-cylinder balanced compound locomotives he sent to us with a letter about the Baldwin-Plant locomotive. The letter was published in our issue of April 11.

By the use of the valve gear herein described for compound engines with two high-pressure and two low-pressure cylinders, the main advantages which these engines present are utilized to their fullest extent and combined with a very simple and cheap construction.

The locomotive is provided with a high-pressure and a low-pressure cylinder on each side arranged as shown. In order to facilitate the mounting and working of the cylinders, they may be made in one piece, as shown in Fig. 1. The two steam pistons on each side are actuating an interior and an exterior crank, being arranged in opposite directions so as to produce the movement of the pistons in opposite directions which results in the partial compensation of the horizontally moving motive power and of the masses operated upon.

Both the steam valves of each pair of cylinders are actuated by but one link-motion while by a suitable arrangement of the valve gear any proportions of cutoff desired may be obtained so as to get the best effect from the engine. In the arrangement as shown in Fig. 1 piston valves with interior admission are employed for the high-pressure cylinders, while flat slide valves are used in connection with the low-pressure cylinders.

*From an article in *Glasers Annalen für Gewerbe und Bauwesen.*

Fig. 2 shows the arrangement of the valve gear diagrammatically. Both the steam valves of each pair of cylinders are not moved equally, but from different points c, d of the main lever $b\ a\ c$; the valve of the low-pressure cylinder is connected at a point d nearer to the point a of the pitman which is driven by the link motion, than the valve of the high-pressure cylinder at c. By this means the high-pressure valve is always in advance of the low pressure valve, giving the high pressure cylinder a shorter cutoff than the low pressure.

This result is illustrated in Fig. 3 by means of the well-known Zeuner projection lines. For simultaneous cutoffs the centers m, n of both circles corresponding to the two valves are about at the same height $O\ e = O\ g$ above and below the center O since these distances are the result of the movement of the link motion which is the same for both valves. In a horizontal direction, however, the center n of the circle corresponding to the low-pressure valve is nearer to the center O than the center m of the circle corresponding to the high-pressure valve, the ratio being approximately $\frac{g\,n}{e\,m} = \frac{a\,d}{a\,c}$ (Fig. 1); hence the low-pressure valve will cause a considerably longer cutoff than the high-pressure one. In the drawing the ratio of advance is $\frac{g\,n}{e\,m} = 0.7$, the relation of the cutoff being 0.4 in high-pressure to 0.6 in the low-pressure cylinder.

The relations of cutoff are like the following:

High-pressure cylinder	0.3	0.4	0.5	0.70
Low-pressure cylinder	0.5	0.6	0.7	0.82

This shows a good utilization of the steam, and may be obtained in this manner for movement in both running directions.

In practice it is preferable to actuate an intermediate shaft from the link-motion. In the forked ends of this shaft a special lever for each slide valve is attached, the lower end of which is connected to the cross head of the particular piston. In this arrangement it is possible to obtain different strokes for both valves by a judicious arrangement of the relation of the levers to each other, the influence of the length of the connecting rods upon the distribution of steam being eliminated as much as possible.

As compared with the locomotive with four valve gear appliances, the arrangement here described is considerably simpler inasmuch as two link motions are rendered unnecessary.

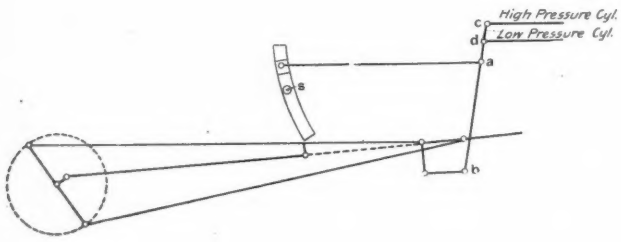


Fig. 2.

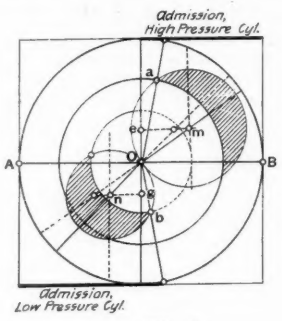


Fig. 3.

A Pioneer in Making Varnish.

Prior to 1827 all the varnish offered for sale in this country had been imported, although it had been the custom for carriage painters and repairers to make small quantities in their shops for their own use. Pascal B. Smith conceived the idea, in that year, that a business could be built up by manufacturing varnish for concerns using varnish in their business, and he erected a shed in an old apple orchard near what is now the corner of Second avenue and Sixth street, in New York City, and this small shed was the first varnish factory in America.

In 1829 he called to his assistance Mr. James L. Stratton, a practical house painter, and his brother, Samuel P. Smith, who gave up his business to become a partner in the new firm of P. B. Smith & Co. Soon after its organization, the firm erected a factory at Astoria, establishing their office at 127 Maiden Lane. Jealousy in the management resulted in 1832 in the withdrawal of Mr. Samuel P. Smith, who went to Newark, N. J., and there established a varnish factory of his own.

In 1844 Mr. Pascal B. Smith retired from the firm,

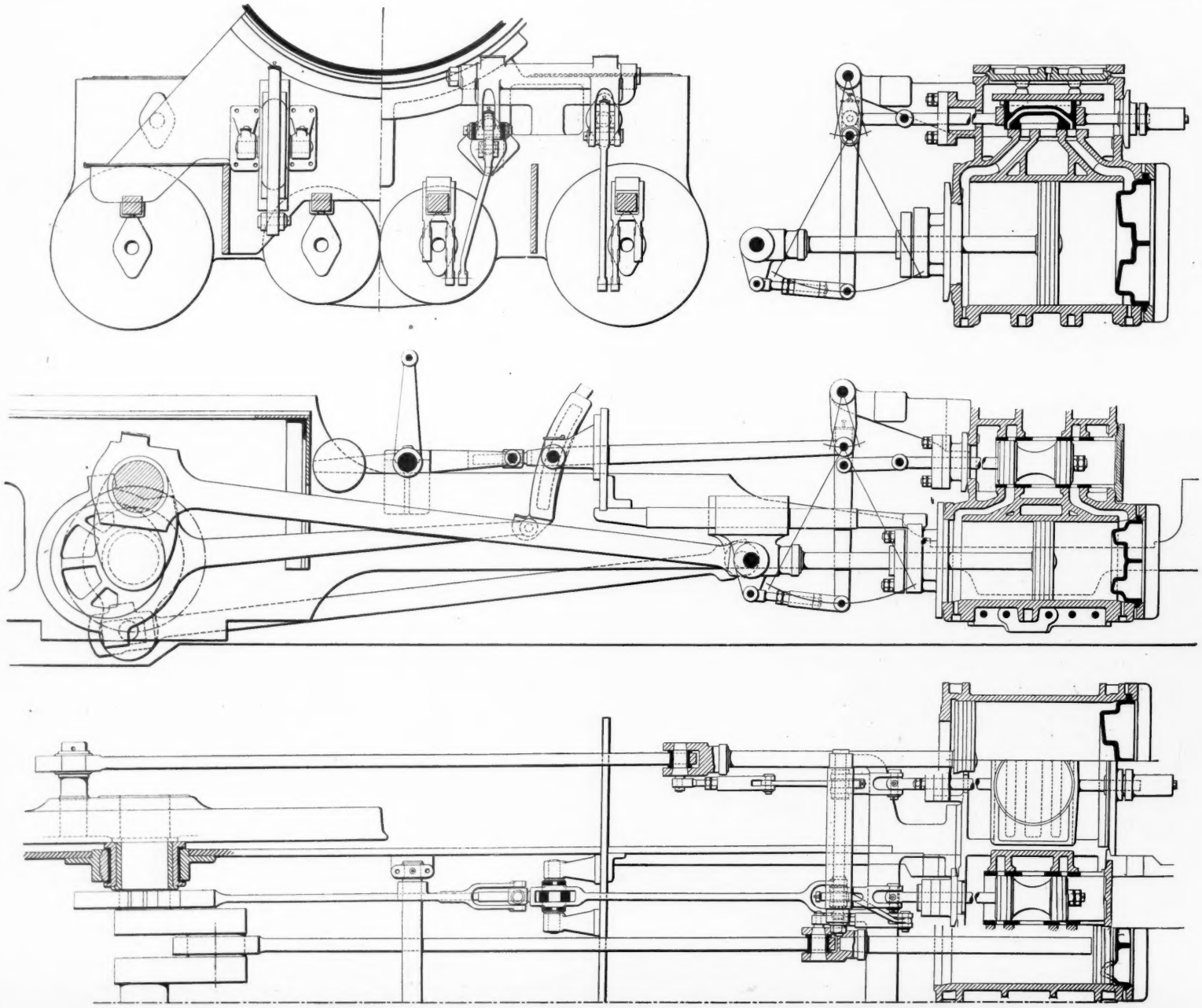


Fig. 1.—Von Borries' Valve Gear for Four-Cylinder Balanced Compound Locomotives.

having accumulated what was considered an immense fortune. Edward Smith was admitted as an equal partner, and the firm name became Edward Smith & Co. This name continued until 1850, when, on the death of Nathan Smith, it was changed to Smith & Stratton. At this time the office was moved to 141 Maiden Lane, where it continued until the death of Mr. Stratton in 1859.

In 1856 the factory was moved from Astoria to Hunter's Point. The year 1856 was also marked by the entrance of Mr. J. A. Elmendorf into the employ of Smith & Stratton. He continued his connection with this firm and its successors until his death in 1900, at which time he was Vice-President of the present corporation.

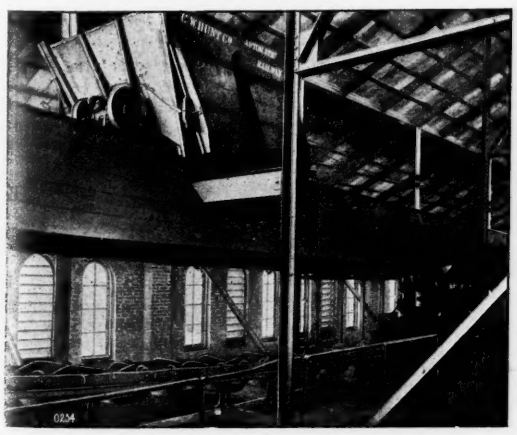
In 1867, Mr. Elmendorf was made a partner by Mr. Smith and the firm name was again changed to Edward Smith & Company, which still continues as the style of the business. In November, 1878, Mr. Edward Smith died, and his son-in-law, Mr. Chester Huntington, took his place in the firm, the partners being Mr. Elmendorf and Mr. Huntington. In 1880 Mr. Alexander Maitland became a member of the firm, and in 1889, the business was incorporated under the same name, the officers being: President, Alexander Maitland; Vice-President, John A. Elmendorf; Treasurer, Chester Huntington; Secretary, A. M. Bates, and Superintendent, S. V. V. Huntington. In 1892, Mr. Chester Huntington retired as an officer of the corporation, and S. V. V. Huntington was elected in his stead, since which time he has filled the position of Treasurer and Manager.

In the earlier days of varnish making Zanzibar, Benguela, Angola and pebble gums were used almost exclusively. Afterward, Manila gum came into the market for the cheaper varnishes until the extensive importation of Kauri gum, which was first used in varnish making by Smith & Stratton. The first lot came to this country direct from New Zealand about 1846. A ship had gone to New Zealand on a trading venture and after the captain had disposed of his cargo he found the vessel without ballast to sail back. On looking for something to load his ship with, he found a great quantity of this Kauri gum piled up in one of the towns and made up his mind that it could be used for some purpose and at once bargained for it. He loaded his ship with it and sailed for home. On his arrival he could find no purchaser. He, therefore, hired a barn near New Bedford, Mass., and filled it with the gum. Some two or three years after, an Irish-Englishman by the name of John Boyd took hold of the lot and came to Smith & Stratton with samples, and they purchased the first hundred thousand pounds for 2½ cents per pound. The gum became in immediate demand and the whole was disposed of at continually advancing prices. Smith & Stratton purchased the last 10,000 lbs. of the cargo at 35 cents per lb. In 1853, after Kauri gum became a regular article of importation into this country, the price began to fall again until it reached 5½ cents in 1860.

The original kettle which Mr. Pascal B. Smith used for boiling his varnish, when he first began business in the shed under the apple trees, is still preserved in the office of Edward Smith & Company.

Coal Handling Machinery in the Pratt Street Station, Baltimore.

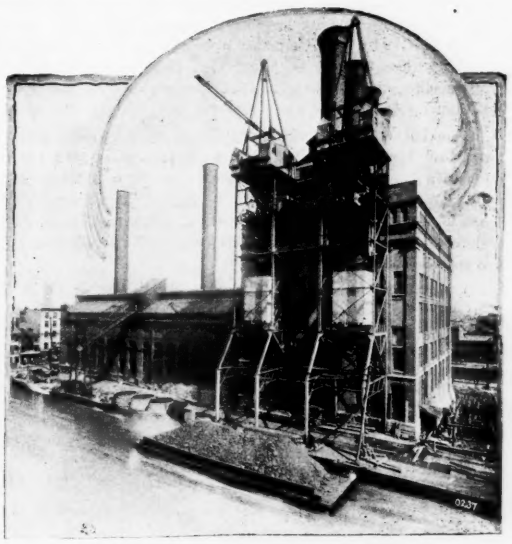
A power plant like the enlarged Pratt street station of the United Railways & Electric Company, Baltimore, consumes not far from 100,000 tons of coal a year. To receive such quantities of coal and deliver it to the stokers is costly, especially where the boilers are on different floors. The new boiler house shown in the illustration is 94 ft. wide by 131 ft. long, divided into two parts by four stacks, each 200 ft. high and 13½ ft. internal diameter. There are 16 B. & W. 500 h.p. boilers on the first floor and the same number on the second. Above the boilers on either side of the stacks are two coal bins, having a storage capacity of 6,000 tons. Over each of



Hunt Conveyor and Motor.

the bins is the Hunt automatic railroad, extending the length of the building, and into the towers. The coal hoisting towers and machinery were designed and built by the C. W. Hunt Company, while the arrangement of the electrical apparatus in the tower is due to P. O. Keilholtz, Consulting Engineer of the United Railways & Electric Company.

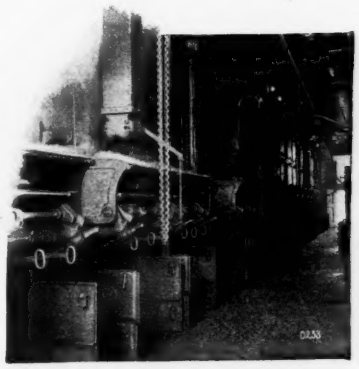
On the east side of the boiler house, two steel towers were built for hoisting the coal, one of which has been equipped throughout, while work on a duplicate equipment is in progress. This plant has the highest hoist of any power station, and is the only one of its kind equipped throughout with electrically operated hoisting and conveying machinery. Each of the coal hoisting



Coal Hoisting Towers at Pratt Street Station.

towers is 183 ft. high, and the horizontal booms, 52 ft. in length, extend over the water. The one-ton shovel is lowered by means of a cable, passing over a truck which runs back and forth on the booms to the shovel below. The shovel hoist and boom truck are driven by electric motors geared to the hoisting drums.

When the shovel descends to the coal in the barge, the hoisting motor is started and closes the shovel, fills it with coal, hoists it, loaded, 151 ft. over the tower and dumps the coal into a hopper at the front of the tower on the engine platform. The shovel is then lowered open to the coal, and is ready for another trip. An engineer



Boiler Fronts and Coal Chutes.

and assistant regulate the operations of the hoisting machinery from the second platform in the tower, the former controlling the hoisting drum motor, and regulating the speed and direction of rotation; the latter controls the motor hoist actuating the trolley on the boom. The shovel does not twist in hoisting or lowering. The coal passes from the hopper through a Hunt coal cracker, where the large lumps are broken to the proper size for automatic stokers. By means of a double jawed cut-off valve, the coal is fed into a Hunt automatic car and weighed. After the car is pushed off the scales it passes to an inclined track over the bins, and is automatically discharged by a stop previously located at the point where the coal is needed. The inertia of the loaded car on the incline is stored in a counter-weight which, when the load is dumped, returns the car to the scale for another load.

The tower has a capacity of 50 tons of coal an hour. Recent records show that the hoist will deliver considerably more coal than the capacity given above. While the consumption of coal would probably be 100,000 tons a year, the coal handling plant has a capacity of ten times that quantity of fuel taken from the boat and delivered to the storage bins.

Under each of the boilers is an ash hopper with a cut-off valve; the Hunt noiseless gravity bucket conveyor receives the ashes which descend into and are removed from the hoppers by gravity. The ashes are carried over the coal pockets and dumped into a chute leading into ash bins in the tower, from thence they are removed by car or boat. This conveyor is 430 ft. long with a vertical lift of 86 ft., and is motor driven. When carrying a load of ashes, it requires but 5 h.p. to keep it moving, which is a demonstration of its mechanical efficiency. No shoveling or manual labor of any kind is required in receiving, transporting or emitting coal or ashes from this plant, and the machinery is as nearly automatic in its operation as possible.

Friction of Steam Engines.

BY WM. WALLACE CHRISTIE.

The results given below are those obtained by me when making power tests, on engines as I found them running. That is, there was no preparation whatever made to secure low horse-powers.

They do not cover a very wide range of sizes of engines, but are valuable in showing what proportion of an engine's rated power is used up by the engine within itself before any energy is given through the belting to the shafting and machinery.

Howes & Phillips, Corliss, simple, 16 x 38-in. cyl. connected only to main counter.

Rev. per min.	Indicated h. p.
60	7.05
64	6.95
66	6.96
68	7.52
68	7.17
68	8.76
70	7.91
72	6.51

Same size and make as above, under similar conditions, connected to main counter, at 72 rev. per minute, indicated 6.9 h. p.

Same size as above, 69 rev. per min. with 100 ft. of 3-in. shaft, 19 h. p.

Eclipse "Corliss," 14 x 30-in., 90 rev. per min., main belt to counter, 9 h. p.

Corliss, 8 x 20-in., 86 rev. per min.; engine alone, 1 h. p. 6-ft. dia. x 12-in. fly-wheel.

Buckeye Automatic, simple, 15 x 30-in. cyl., belt off, engine alone, at 100 rev. per min., indicated 8.71 h. p.

Donegan & Swift, Metropolitan, 12 x 16-in., 150 rev., with main shaft to clutches, short line, indicated 6.25 h. p.

Houston, Stanwood & Gamble, 12 x 18-in., 160 rev., engine alone, indicated 3½ h. p.

Porter, slide valve, 16 x 30-in., 72 rev., engine alone, indicated 6 h. p.

Williams Engine, rated at 150 h. p.:

I. H. P.	Brake H. P.	Dif. or friction H. P.
12.5	0	12½
49.	38	11
104.5	94.5	10

All but the last are results obtained by the writer.

Driving a Drainage Pipe.

Along the route of the Toronto, Hamilton & Buffalo Railway, between Hamilton and Buffalo, the road climbs the face of what is called the "Niagara Escarpment," which is about 300 ft. high. In this climb the road crosses, in one place, a deep gully by means of a heavy embankment. A large iron drainage pipe was originally laid at the bottom of this gully, but had been entirely washed away, and it was found that the spring water dripped in considerable quantities along the face of the escarpment and gully, and resulted in frequent slides. To correct this fault sheet filed intercepting drains had been constructed at the intersection of the toe of the embankment and the side hill, and made to drain into a well sunk in the rock at the lowest point of this pocket. The water from this well was then pumped over the embankment and carried down on the other side by a wooden flume.

To obviate the necessity for this pumping station, it was decided to drive a drainage pipe through the embankment. The distance was 110 ft.; 95 ft. to be driven and 15 ft. at the upper end of the rock to be excavated. The height of the track above the grade of the pipe was 35 ft. The material to be driven through was sand, clay and a little rock, all being very tightly packed. The method of driving was to force the pipe ahead by means of jacks, to keep the inside of the pipe clear of earth, etc. (there being no drive point on end of pipe) by means of a jet of water, and to remove rock obstructions by sending dynamite up through the pipe.

A shelf on which to place the cradle for holding the pipe for driving was first provided by excavating on the down hill side of the dump (see Fig. 1). Then the ways for the cradles (12 in. x 12 in. x 28 ft.) were placed parallel to the pipe line. On these ways there were four sticks set crosswise: three movable pieces 6 in. x 12 in. x 3 ft. acting as cradles, and one stationary

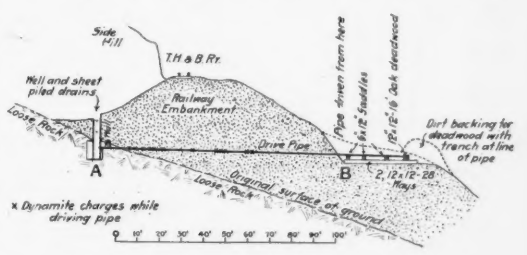


Fig. 1.—Driving a Drainage Pipe Through an Embankment on the T. H. & B.

piece (12 in. x 12 in. x 16 in.) acting as dead wood for the jacks. Behind this fourth stick, an earth backing was piled.

Two 6 in. x 12 in. x 3 ft. timbers were clamped around the end of the pipe as a bearing for the jacks, leaving the mouth of the pipe open and unobstructed. The pipe (20 ft. long) could then be jacked ahead its full length, and when blocking was removed another length of pipe could be screwed on and the process continued.

In order to keep the pipe clear, water was furnished through a flexible inch hose, from the steam pump at the well, and was delivered at the drive end of the pipe

by connecting the hose to an inch gas pipe, this being pushed up to the end of the drive pipe. The gas pipe had an iron guide on the end to keep the nozzle in the center of the large pipe. The face on the guide was large enough to keep rocks out of the end of the pipe, but had openings in it to allow free backward flow for puddled sand and mud. The nozzle was always kept rammed well up to the end of the drive pipe. In the drive of 95 ft. the pipe should not deflect more than one foot, and for this reason it was necessary to listen carefully for the metallic ring of the nozzle when it struck the rock. Whenever rock was struck, the hose was unscrewed, the inch pipe withdrawn, the nozzle unscrewed, and a dynamite cartridge tied to the end and carefully pushed back again. The jacks were then reversed and the large pipe drawn back 5 or 6 ft. The charge was then fired by electricity. The dynamite cartridges were made on the ground of ⅜ in. pine boxing about 16 in. long, and small enough to slip easily through the drive pipe. The box was packed with dualine and held from 1½ to 3 lbs. Twelve days were consumed in driving the 95 ft., two 15 ton ratchet screw jacks being used for the work. The pipe appeared at the well end of the drive, but 10 in. from the point calculated. This work was done in April of 1898, since which time no trouble whatever has been experienced from slides.

We are indebted to Mr. E. Fisher, General Supt., T., H. & R., for the above information.

TECHNICAL

Manufacturing and Business.

The American Railway Supply Manufacturing Company, of Pittsburgh, was chartered in Delaware, July 21, to make and deal in railroad signals and supplies; capital, $150,000.

W. P. Cosper, for the past eight years Western Representative of the Consolidated Car Heating & Lighting Co., of Albany, N. Y., has been appointed Sales Agent of the railroad department of Fairbanks, Morse & Co., Chicago.

John F. Harrigan has retired from the service of the Fulton Iron & Engine Works, of Detroit, Mich., to become Vice-President and General Manager of the National Brass Manufacturing Co., with headquarters at St. Louis, Mo.

The Mutton Hollow Fire Brick Co. has recently made some extensive additions to its plant at Woodbridge, N. J. The company is now in a position to produce, in large quantities, high grade fire brick, tile, slabs, cupola linings and special fireclay goods.

Thornburgh tandem coupler attachments will be placed on the 500 cars recently reported in our issues as being built at the shops of the Gulf & Ship Island; on 700 cars at the shops of the American Car & Foundry Co., and 500 to be built at the shops of the Nashville, Chattanooga & St. Louis.

The Standard Steel Car Company is equipping its new plant for electric driving throughout. A recent purchase from the Westinghouse Electric & Mfg. Co. comprises two 375 K.W., A. C. generators, one 400 K.W., D. C. generator, and a 300 K.W. rotary converter for use as a connecting link between the two. This company has, also, purchased about 50 induction motors, which will be used largely for direct connection to machine tools.

On July 17 the 25,000 h.p. water softening plant installed at Ensley, Ala., by the Pittsburgh Filter Mfg. Co., Pittsburgh, Pa., for the Tennessee Coal, Iron & Railroad Co., was started and is working satisfactorily. The plant will purify the water used by the boiler plants of the blast furnaces, steel works, mines, etc., of the Tennessee Coal, Iron & Railroad Co., and, we are informed by the builders, is the largest water softening plant in the world.

Walter D. Crosman has resigned as Western Representative of the Gold Car Heating & Lighting Co. to become Sales Manager of the railroad department of the Western Roofing & Supply Co., 195 Lake St., Chicago. The company handles a complete line of roofings, linings and coverings, including 85 per cent. magnesia locomotive laggings, roofing and insulating materials for cars and for all classes of railroad buildings, pipe coverings, coil water paints, asphalt paints for boiler fronts, etc.

Jones & Laughlins, of Pittsburgh, have recently ordered from the Westinghouse Electric & Mfg. Co. one 800 K. W., D. C., generator, two 150 K.W., motor-driven, two-phase alternators, and two 125-light, motor-driven arc generators. The Doylestown Electric Company, of Doylestown, Pa., has ordered from the Westinghouse Electric & Mfg. Co. two 100 K.W., engine-type, two-phase alternators with direct-connected exciters, complete with switchboard. The engineer for the work is Dr. W. A. Drysdale, of Philadelphia.

Iron and Steel.

Col. Charles James, who organized the Norway Iron & Steel Co., designed and equipped its plants and has been manager since it has been in operation, has resigned.

Colonel George D. Wick has retired as president of the Youngstown Iron, Sheet & Tube Co., on account of ill-health. The stockholders of the company will meet next week to elect a successor.

The Tennessee Coal & Iron Co., the largest producer of pig iron in the South, has opened its books for orders for pig iron for delivery in 1903 on a basis of $17 a ton, No. 2 foundry, Birmingham.

An effort is being made to consolidate the blast furnace interests of the Shenango and Mahoning valleys. The project contemplates, it is said, the formation of a company to take over 30 furnaces.

E. A. C. Lohmann, a steel expert, died on July 20, in Bethlehem, Pa., where he was employed by the Bethlehem Steel Co. He invented the process for hardening steel used by the Carpenter Steel Co., makers of the navy's projectiles, and was with the Carpenter Co. for many years, up to a short time ago.

The International Foundry Company was incorporated in New Jersey, July 16, with a capital of $5,000,000, to manufacture brake-shoes under the patent of Charles Svekely and to manufacture iron castings. The incorporators are Claude L. Stillman, of Newark; Nathan Divader, Nathan Boehm, Charles Svekely, New York; Frederick Parsons, of Tarrytown, N. Y.

Contracts have been let by the Baltimore & Ohio for 40,000 tons of rails, to be delivered next year. A year ago the company ordered 60,000 tons for delivery during 1902. The distribution of the contracts to the various mills in the United States Steel Corporation has not been made. The Maryland Steel Co. and the Cambria Steel Co. have been awarded a part of the order.

Extension of Block System on B. & O.

The Baltimore & Ohio has established the telegraph block system on the Pittsburgh Division, between Pittsburgh and Cumberland, 150 miles. At the switches of outlying side tracks telephones have been put in, to enable trainmen to report to the block signalman when they have cleared the main track.

More Disk Signals on the North Western.

The Chicago & North Western has ordered from the Hall Signal Company 87 disk signals to equip the line of the road, double track, from Rochelle, Ill., to East Clinton, 64 miles. The signals will stand normally in the clear position, and overlap circuits will be used, there being no distant signals. The total number of electric circuits in the rails of the track will be 287. Besides the 87 new signals there are 20 signals which will be controlled by electric slots. There are 64 switches in the line to be equipped. These will have the usual protection, with visual indicators. This installation completes the automatic block-signaling of the North Western from Chicago to the Mississippi River, 137 miles.

A New Rail-Joint.

A solid rail-joint of the form shown in the accompanying engraving has recently been patented and placed upon

the market by Mr. John Gillen, Fort Worth, Texas. As will be seen this joint or chair is formed of one piece of metal, of a shape to conform to, and closely embrace the base, web, and underside of the crown of the rail. It is provided near its extremities with recesses to be engaged by the spikes, and intermediate of the ends is a transverse recess to permit application of the fish-plates to the rails. The form of the chair is such as to procure great stiffness and give a smooth joint to the rails.

Decision in Canda Draft-Gear Patent.

In the case of Canda Bros., of New York, against the Michigan Malleable Iron Co., of Detroit, District Judge Henry H. Swan, in the United States District Court, at Detroit, has decided in favor of the defendant, and the bill is dismissed with costs. The defendant was charged with having infringed certain claims of patent No. 460,426 granted Ferdinand E. Canda, Sept. 29, 1901. The infringement charged was based upon the manufacture by the defendant, under contract then existing with the Thornburgh Coupler Attachments Co. Ltd., of draft apparatus, shown in patent 588,722 granted to William Thornburgh, Aug. 24, 1897. The decision sustains the validity of the Thornburgh patents.

Disappearing Gun Carriages.

The Secretary of War has appointed a board to report upon the disappearing gun carriage for seacoast fortifications, in accordance with a provision by Congress that a test of the disappearing carriage shall be made before more are ordered. The members of the Board are Col. Wallace F. Randolph, Chief of Artillery, U. S. Army; Capt. E. H. C. Leutze, U. S. Navy; Maj. J. G. D. Knight, Corps of Engineers, U. S. Army; Maj. Charles Shaler, Ordnance Department U. S. Army; Maj. A. D. Cummins, Artillery Corps; Maj. B. H. Randolph, Artillery Corps, and Mr. John R. Freeman, of Providence, R. I. The board met in Washington July 22, and will meet at such other times as may be necessary.

Naval Docks.

Plans and specifications for the new stone dry dock at the Norfolk Navy Yard, recently authorized by Congress, have been completed and are being issued by the Navy Department. The dock is to cost $1,200,000.

The floating dry dock which was brought from Spain will be left at Havana until the question of coaling stations is settled, when the Navy Department will decide whether to keep the dock at one of them or to bring it to the United States. The plan of towing the dock to the Philippines which was considered was given up, as an appropriation was made by Congress for a new steel floating dock for the naval station at Cavite. P. I., to cost not over $1,225,000.

The Niles Car & Manufacturing Company.

The plant of the Niles Car & Mfg. Company, at Niles, Ohio, has been finished and opened. There are three large brick buildings, work on which was begun last March. The office building, boiler rooms and blacksmith shops are connected with a large building, 202 x 120 ft. The second and third buildings are both 130 x 202 ft. The officers of the company: George B. Robbins, President; A. G. McCorkle, Vice-President; William Herbert, Treasurer; A. L. Jacobs, Superintendent; C. P. Souder, Secretary and General Manager; George E. Pratt, Assistant Manager and Contracting Agent. The product of the works will be street cars. The first shipment will be made to the Aurora, Elgin & Chicago Street. There are 10 cars in this order, and each car is built to run 70 miles an hour. These cars are not supplied with a trolley pole, but will be run on the third-rail system. Whistles are used in place of bells.

Coke On the Boston & Maine.

For the last three years the Boston & Maine has been using coke as a regular practice on local passenger trains and in much of its switching service. The company uses 600 tons a day, all that it can procure.

A New Explosive.

"Masurite" is the name of a new explosive made by the Masurite Explosive Company, of New York. The company claims that this compound cannot be exploded except by means of double strength electric fuses. In order to substantiate these claims some tests were made last week in the presence of a number of railroad men, fire underwriters and others. To show the effect of concussion upon a cartridge made of this compound, a 75-lb. hammer was allowed to fall from a height of 25 ft. The cartridge was not exploded. Other tests were made by firing four shots from a Government rifle into a large case of the explosive, similar results ensuing. A cartridge placed in a blacksmith's forge was entirely consumed without exploding. Ordinary explosives are rendered non-explosive by low temperatures. One of these cartridges was subjected to a temperature of 10 deg. Fahr. for a period of four hours, after which it was placed in a hole bored in a large rock and exploded, shattering it into fragments. In all the tests there was no perceptible flame accompanying the explosion, nor were any disagreeable odors detected. Dr. Charles B. Dudley, of the Pennsylvania Railroad, witnessed the tests and is reported to have been highly pleased with the results.

A Decision in a Pneumatic Tool Case.

At a Special Term of the United States Circuit Court, Northern District of New York, at Utica, July 15, a decision was rendered by Judge Coxe in the case of J. G. Timolat and the Chicago Pneumatic Tool Company against the Franklin Boiler Works Company and the Philadelphia Pneumatic Tool Company. From the finding and order we make the following brief extract, endeavoring to present the matter precisely as it comes from the Court so far as the essential meaning goes.

The case was a motion for a preliminary injunction to enjoin the defendants from the further manufacture, sale, purchase or use of the Keller-Philadelphia pneumatic drill, made by the Philadelphia Pneumatic Tool Co. Infringement was claimed of a patent granted to John Moffet, Aug. 30, 1887, for a portable drilling machine. The Court finds that the tool in question, made and sold by the Philadelphia Pneumatic Tool Co., and purchased and used by the Franklin Boiler Works Co., is an infringement of this patent No. 369,120. It is ordered that a preliminary injunction be granted restraining the Franklin Boiler Works Co. from making, selling, buying or using any portable drilling machine violating this patent and especially "from the further manufacture, sale, purchase or use in any manner or way whatsoever, of the so-called Keller-Philadelphia pneumatic drill." We are informed that an appeal will be heard, possibly as early as next September.

The Philadelphia Public Works Bonds.

Mayor Ashbridge, of Philadelphia, is about to make allotments of $6,400,000 of bonds for which proposals have just been received. The most important work for which the funds will be used are for the abolition of grade crossings on the line of the Philadelphia & Trenton R. R., for the extension, improvement and filtration of water supply, extension of Fairmount Park, repaving streets, building new bridges and repairing old ones, building police station houses and for electrical and underground construction.

New York's Harbors and Rivers.

Col. S. M. Mansfield, Corps of Engineers, U. S. A., has made his annual report to the Chief of Engineers on the improvements of the rivers and harbors in and about New York city. The following are the estimates: East River and Hell Gate, to complete the project, $903,840; for the fiscal year of 1904, $400,000; Harlem River, to complete the project, $1,380,000; for the fiscal year 1904, $500,000; Hudson River, to complete the project, $1,040,356; for the fiscal year, 1904, $425,000; Peekskill harbor, for the fiscal year 1904, $33,000.

The Plattsmouth Bridge of the Burlington.

The Chicago, Burlington & Quincy is rebuilding the bridge over the Missouri River near Plattsmouth. The present bridge consists of two 400-ft. through spans, and three 200-ft. deck spans, with an iron trestle approach at the west end. It was built in 1880-81. The company decided to replace all of the superstructure with a new single-track bridge. There has been built a pier in the

center of the east 400-ft. span and two 200-ft. deck spans will be put in instead of renewing the 400-ft. span. This pier is on pneumatic foundations which were carried 50 ft. below low water to bed rock. The pneumatic foundation work was done by William Sooy Smith & Co., Chicago. All of the small piers supporting the deck spans will be replaced with concrete piers in the same position which they now occupy. On July 1 the company began work putting in the false work preparatory to doing this concrete, and expects to begin the erection of the iron work about Nov. 1. Since Mr. Blake's death the bridge work of the company has been in charge of C. H. Cartlidge, Bridge Engineer.

Michigan Malleable Iron Co.

We understand that work has begun on three new foundries for the Michigan Malleable Iron Co., of Detroit, ground having been broken in that city quite recently for the purpose. It is said that when this enlargement is completed it will give this company the largest capacity for malleable castings in this country. Electric equipment is to be used in the new work, as well as the latest labor-saving devices for foundry purposes.

Sharon Steel Co.

It is announced that all of the plants of the Sharon Steel Co. now building will be completed and in operation by the first of next year. When the new plants are in operation the company will give employment to about 6,000 men and make about 300,000 tons of finished steel a year. The plants now building by that company include a pipe mill with a capacity of 300 tons a day, and a sheet steel plant (12 mills), with a capacity of 100 tons a day. The Coke Co., which is a subsidiary concern of the Sharon Steel Co., will have 212 by-product coke ovens in operation within the next six months. In iron and steel circles the Sharon Steel Co. is regarded as the best equipped as well as the most modern plant in the country. It is an absolutely independent company in the matter of raw supplies. It owns valuable iron ore, coal and limestone properties.

Colorado Fuel & Iron Co.

It will be at least 18 months before the contemplated additions to the Colorado Fuel & Iron Co. are completed. This belief is based on the fact that contracts to the amount of about $1,000,000 have just been placed. The Colorado Fuel & Iron Co. will have a capacity of about 550,000 tons of finished steel when its new plants are completed. The firms awarded these recent contracts are the Riter-Conley Manufacturing Company, the Mesta Machine Company and the American Bridge Company, all of Pittsburgh.

THE SCRAP HEAP.

Notes.

The mileage tickets sold by the New York Central aggregate from 7 to 10 millions of miles a month. The Central now issues books at the rate of two cents a mile, which are good throughout all of its lines east of Buffalo, and also on the B. R. & P. and the Philadelphia & Reading. The coupons are good for any person, or persons, and there is no time limit.

The freight rate war at Louisville, started by the allowance of cartage expenses to shippers by roads whose stations were unfavorably situated, has spread to Memphis and New Orleans. In the latter city on Tuesday of this week it was said that all of the roads had announced, or would at once announce, allowances of two cents per 100 lbs. on practically all kinds of freight handled through freight houses.

It is said that the half-rate excursion tickets offered in Chicago last week for New York led about 1,200 persons to buy the tickets in one day, Thursday. The Erie is said to have taken the largest share of these passengers. Since that day energetic efforts have been made to withdraw the announcements which have been made of these low rates for future dates, and some of the reports indicate that these efforts are successful. It is said that the scalpers bought many of the tickets, the restrictions being relaxed or entirely removed, and that they supplied many passengers with one way tickets to New York at $10.

On the morning of Tuesday, July 15, the eastbound Twentieth Century Limited, of the New York Central, ran from Buffalo to Syracuse, 149 miles, in 145 minutes, including a stop of about two minutes at Rochester. The 80 miles from Rochester to Syracuse was run in about 74 minutes; not 57 minutes, as has been stated in the daily papers. The time through from Buffalo to New York, 440 miles, was 8 hrs. 9 mins., which is six minutes better than the schedule time of the westbound Empire State Express. On July 19 the 20-hour train was again late in leaving Buffalo, and made up nearly as much time as on Tuesday.

Carbonic Acid in London Tunnels.

A serious question has arisen in connection with the underground tube railway. It has been argued that the ventilation was automatic and well-nigh perfect by reason of each train nearly filling the tube and acting like a piston, forcing out the bad air and drawing in the fresh air. The public accepted this theory; as there were no bad odors, it was assumed that the atmosphere was healthful. But recently the cars at certain hours have been badly crowded and passengers began to complain of dizziness. It was found that this was due to the presence of a great excess of odorless carbonic acid gas generated by human lungs. A healthy atmosphere should not contain a larger proportion than seven parts in 10,000 of this gas. The standard of purity required in English workshops by the Factory act, is not to exceed nine. Three tests were recently made of the air in the tube. The first sample, taken from the top of a crowded car, showed 27½ parts of carbonic acid gas. This is distinctly poisonous. A second sample, taken from a moderately filled car, showed 13 parts. A test made of the air at a station as a train was leaving, when the purest air should be obtained, showed 13 $^{5}/_{10}$ parts. It is believed that this serious situation can be much improved by closing all the openings between the two tubes. There is always a lively breeze blowing in the present tubes, but the foregoing tests show that the air simply moves in what may be described as a vicious circle.—New York *Sun*.

To Keep Alive the Love of Country.

The Sterlingworth employees have inaugurated a club known as the "Sterlingworth Employees' Lincoln Club." Meetings are held monthly in a little club room, in which are hung the pictures of Lincoln and Washington. At each meeting, little talks of Lincoln's life are given by the members. The memorizing of Lincoln's Gettysburg address, and the "Star Spangled Banner" are qualifications of membership. On Lincoln's birthday a banquet is to be given. This club is the outgrowth of the patriotic inspiration aroused among these employees by the little Flag Association, which has been in existence since the first day's operation of the plant, 17th of July, 1896. This Association, made up of the employees, has kept the flag afloat over the works every day, excepting Sundays. A new one is purchased each year, and raised on the Anniversary Day, July 17th, and the old one hauled down, wrapped up and preserved in the president's office.

An Employment Office for Scientific Men.

R. G. Wilson, an electrical engineer of many years' experience has recently organized the Scientific Exchange in Chicago to provide an introduction between the buyer and seller of the best scientific service. The exchange proposes to maintain filed records of engineers, draftsmen and specialists in all scientific branches, these records to be open to the inspection of employers.

Completion of Railroad in Nicaragua.

Minister W. L. Merry, of San José, reports the completion of the railroad connecting Managua with Corinto, via La Paz, a station on the line between Corinto and Lake Managua. This line will shorten the time between Corinto and Managua by about four hours, by doing away with trans-shipment at Momotombo. The railroad, which is owned by the Government, is about 35 miles long and has been constructed of metal from the United States, at a cost of about $12,896 a mile. The Government has had three steel-screw steamers on Lake Managua, two of which will now be transferred in sections to Lake Nicaragua and relaunched, making four steamers on Lake Nicaragua and two on Lake Managua.—*Consular Reports.*

New Military Post.

The Secretary of War has issued an order for the establishment of the first of four great military posts which are to be the gathering places for the U. S. Army in case of war and in time of peace are to be training schools for both regular army and militia forces. The post authorized will be at Chickamauga, and $450,000 has been allotted for the construction of a post there to accommodate a full regiment of cavalry and a company of artillery.

Butting Collisions on Electric Roads.

Not a collision now occurs on a Massachusetts street railroad without being followed promptly by an inquiry on the part of the State Railroad Commission. The commission has made a careful inquiry into the head-on collision, on the Brockton & Plymouth, in the town of Hanson; also the bad collision on the Worcester Consolidated road, near North Grafton.

In the Hanson case there were no block signals; the "train despatcher" on the road worked over the telephone. He thought he had arranged for the cars to meet at a given point. They met, but met "between switches." The Railroad Commission found a direct dispute about the orders that were given over the telephone. The commission cannot prove or disprove the statement of either man, as the message was sent over the telephone, without any written record.

On the Worcester Consolidated road, it seems that while the block signal worked all right, so far as concerned the first car to pass the switch, the road was running other cars (for an excursion party) on the first car's time, and the conductor or motorman of the first car was expected to tell the waiting car of that fact. Nothing was said, so the waiting car went ahead, and of course the collision followed.

The street railroads themselves are working almost as hard as the Railroad Commission is, to get at some system that will make such accidents almost impossible. Each accident is followed by new efforts to correct the weak spots in the operating system. The steam roads had to go through the same experience, in their earlier days, before the present improved block system was worked out. All over the State street railway men are puzzling over the problem of safety signals and are working with the Railroad Commission toward that very end. One bad collision may use up all the available assets of a road, in payment of damage suits. For that reason alone, if for no other one, the street railroads want to get on a safer basis as quickly as they can.—*Boston Advertiser.*

The Crops.

Officials of the St. Paul report crop conditions in their territory ideal, with business keeping up to the high-water mark. "I have never seen such uniformity in the condition of growing crops in all my 30 years' experience," said one of the traffic men. We can see a heavy traffic ahead, and the road is well able to meet a large increase in business and handle it economically, but it is feared the tonnage will outgrow our previous provision for meeting it."

Officials of the Burlington say that Nebraska is in the midst of the greatest winter wheat harvest in its history, and that estimates of the crops of both wheat and corn have been entirely too low. Progress of the harvest has been impeded because of the inability to secure laborers, and as high as $3.50 a day is being paid for experienced hands. Corn is fully two weeks in advance of its usual condition at this season.

"We are making inducements to men who seek the harvest fields of the far Northwest," said an officer of the Chicago & North Western, "or at least we will be doing so within a week. All the Chicago-St. Paul lines will join in the movement to reduce rates to the Twin Cities for the purpose of sending men to the grain fields of the Dakotas, where the farmers are hard pressed for help."

The *Northwestern Miller* says: "Weather in Northwest during week has been very favorable to crops. While bright summer weather has prevailed, cool breezes have tempered it, and it has been just the thing for wheat and other grains. Though wheat is a week or more backward and is progressing finely, it is now heading, and next week in a good deal of territory it will be in the milk. The next 20 days will be the critical period for the spring wheat crop. Fields examined show large heads and indications are for a heavy yield to acre."—*Wall Street Journal.*

LOCOMOTIVE BUILDING.

The Michigan Alkali Co. is having a locomotive built at the Baldwin Works.

The Chicago, Milwaukee & St. Paul is in the market for locomotives.

The Mobile & Ohio has ordered 15 10-wheel, and one consolidation locomotive from the Baldwin Works.

The Alabama Great Southern is having three engines built at the Manchester Works of the American Locomotive Co.

The Missouri Pacific has placed an order for 50 locomotives with the Brooks Works of the American Locomotive Co.

The Cincinnati, Richmond & Muncie has ordered five 10-wheel freight locomotives from the Baldwin Locomotive Works.

The El Paso & Northeastern is having six locomotives built at the Baldwin Works, besides the four recorded in our issue of July 18.

The Bear Creek Mill Co., Manistee, Ala., has ordered a freight engine from F. M. Hicks, rebuilt by the Hicks Locomotive & Car Works.

The Illinois Central has ordered 12 consolidation locomotives from the American Locomotive Co. About 38 locomotives are also said to have been ordered from the Rogers Works.

The J. M. Richey Co., Mark Tree, Ark., has bought from F. M. Hicks one logging engine, rebuilt by the Hicks Locomotive & Car Works.

The Great Northern of Canada is having two locomotives built at the Brooks Works of the American Locomotive Co., besides the two building at the Pittsburgh Works, reported in our issue of July 18.

The Hocking Valley order for locomotives reported in our issue of July 11 calls for 10 simple consolidations from the Rogers Works, and five six-wheel switches, from the Brooks Works of the American Locomotive Co. The Rogers engines will weigh 150,000 lbs.; on drivers, 133,000 lbs. Cylinders, 20 x 26 in.; drivers, 54 in.; Belpaire wagon-top boilers, with working pressure of 180 lbs., and 240 National "Syracuse" tubes, 13 ft. 10 in. long, and 2 in. outside diameter. Fire-box of Otis steel, 108 x 41 in. The Brooks engines will weigh 113,000 lbs., all on the drivers. Cylinders, 19 x 26 in.; drivers, 50 in.; Player-Belpaire wagon-top boilers, with working steam pressure of 180 lbs., and 225 National "Syracuse" tubes, 11 ft. 1¼ in. long, by 2 in. wide. Fire-box of Otis steel, 97 x 33 in. Special equipment for both classes includes Hammered steel axles, Buckeye couplers, Star headlights, Ohio injectors, U. S. Metallic piston and valve-rod packing, Tippett safety valves, Leach sanding devices, Michigan sight-feed lubricators, Scott springs, Crosby steam gages, Standard driving wheel tires, chilled plate truck and tender wheel tires, and cast-iron wheel centers.

The Boston & Maine has at present 10 passenger engines and 10 six-wheel shifting engines building, at the Baldwin Works, for November delivery. The passenger engines are eight-wheel, simple, weighing on drivers, 77,000 lbs.; total weight, 116,000 lbs.; cylinders, 18 x 24 in.; drivers, 69 in.; radial-stay extended wagon-top boilers, with working steam pressure of 190 lbs., and 267 tubes of lap-welded charcoal iron, B. & M. special grade. Tubes are 11 ft. 7½ in. long. Fire-box, 90 x 41⅝, inside measurement, of Carbon Steel Co.'s fire-box steel. Tank capacity for water, 4,000 gal.; coal capacity, seven tons. The switch engines weigh 100,000 lbs., all on the drivers. Cylinders, 18 x 24 in.; 50 in. drivers; straight radial stay boilers, with working steam pressure of 150 lbs., and 168 tubes. Length of tubes, 13 ft. 9½ in. Dimensions of fire-box, inside, 72 x 33 in. Tank capacity for water, 3,200 gal.; coal capacity, six tons. Special equipment for both types of engines includes Westinghouse air-brakes, Best hammered steel axles, Sterlingworth "Ideal" and "Reinforced" brake-beams, Tower couplers, Rochester 17 in. reflector headlights, Hancock injectors, U. S. M. Multi-angular piston and valve-rod packings, Ashton safety valves, Leach sanding devices, Baldwin Loco. Works springs, Star Brass Co. and Crosby gages, and Midvale open-hearth driving wheel tires.

CAR BUILDING.

The Mobile & Ohio is in the market for 12 coaches.

The Northern Pacific is in the market for coaches.

The Tennessee Copper Co. is in the market for 100 ore cars.

The Chicago Great Western is reported to be in the market for cars.

The Illinois Central is having 25 coaches built at the Barney & Smith Works.

The Grand Rapids & Indiana is having 68 freights built by the Pressed Steel Car Co.

The Colorado & Southern is having 200 freights built by the American Car & Foundry Co.

The Oregon Short Line has ordered three baggage cars from the American Car & Foundry Co.

The Southern is reported to have ordered 65 coaches from the American Car & Foundry Co.

The Chicago, Rock Island & Pacific is reported to be figuring on a large number of box cars.

The St. Louis & San Francisco has ordered 100 hopper cars from the American Car & Foundry Co.

F. M. Hicks has received orders for 26 flat cars, rebuilt, of 50,000 lbs. capacity, for various parties.

The Seaboard Air Line has been asking builders for prices and delivery on 750 40 ton coal and flat cars.

The Minneapolis & St. Louis is not in the market for cars as incorrectly reported in our issue of July 18.

The Pittsburgh, Cincinnati, Chicago & St. Louis is having 73 freights built at the Pressed Steel Car Co.

The American Car & Foundry Co. has orders for 32 cars of miscellaneous types for different private parties.

The Northern Pacific is reported to have ordered about 2,000 flat and box cars for 1903 delivery, from the new Standard Car Co.

The Chicago, Rock Island & Pacific is building 100 box cars at its own shops with Kindl trucks, Smith doors and Universal bearings.

The Cincinnati, New Orleans & Texas Pacific has ordered 100 freights, to be built at the Lenoir Works of the Southern Car & Foundry Co.

The El Paso & Southwestern has placed an order for 30 flat cars, 50,000 lbs. capacity, to be rebuilt by the Hicks Locomotive & Car Works.

The St. Louis, Troy & Eastern has ordered 50 dump cars from the American Car & Foundry Co., in addition to the order reported last March.

The Tennessee Central, in addition to the order reported in our issue of June 20, has ordered two baggage and mail, and four coaches from the American Car & Foundry Co.

E. H. Harriman has let a number of cars to the Standard Steel Car Co., of which Mr. J. H. Hansen is President, for the Union Pacific, Oregon Short Line, Chicago & Alton and Southern Pacific.

The Detroit Southern order of 500 coal cars placed with the American Car & Foundry Co. reported in our issue of July 11 are for November delivery; of 80,000 lbs. capacity, and weigh about 32,000 lbs. Length, 35 ft. 3 in.; width, 9 ft. 4 in., inside measurements; height, 8 ft. 2¾ in., to be built of wood with wooden underframes. The special equipment includes: Common Sense bolsters, "Solid" brake-beams, Westinghouse air-brakes, Fulton Foundry brasses, and Butler draft rigging.

The Shreveport & Red River Valley order for 100 box cars, reported in our issue of July 11, as placed with the American Car & Foundry Co., calls for cars of 60,000 lbs. capacity; length, inside, 36 ft.; width, 8 ft. 3½ in., and height, 6 ft. 9¼ in., to be built of wood with wooden underframes, for September delivery. Special equipment includes A. C. & F. Co. iron axles, American Steel Foundry Co. bolsters, Christie brake-shoes, Westinghouse air-brakes, Tower couplers, St. Louis flush doors, Miner draft rigging, and McCord journal boxes.

BRIDGE BUILDING.

Atlantic City, N. J.—Bids will be received by the Board of Chosen Freeholders of Atlantic County at 11.30 a. m., Aug. 6, for three bridges near Weekstown. Specifications can be secured on application to John T. Irving, Elwood, N. J. M. L. Jackson, Chairman Bridge Committee.

Altoona, Pa.—The Bridge street bridge will probably be rebuilt by the Pennsylvania R. R. The City Passenger Ry. Co. will pay part of the cost. The foundations are already built.

Beaver City, Neb.—Bids are wanted until 1 p. m., Aug. 7, for four steel span bridges, three to be 28 ft. and one 32 ft., to be placed in different localities. Address T. F. Newton, County Clerk.

Bloomfield, Ind.—A bridge of 100 ft. span will be built over Richland Creek by the County.

Boston, Mass.—The Metropolitan Park Commission has nearly completed its plans and specifications for the new Wellington bridge between Somerville and Medford over the Mystic River, and bids for a part of the work will be advertised for in a few days. In its preliminary work the board has been compelled to secure the approval of the War Department, the State Harbor and Land Commissioners, the Middlesex County Commissioners, the authorities of Somerville and Medford and the Boston & Maine Railroad, as the channel of the river will have to be changed to some extent. The bridge will accommodate the main highway from Boston to Stoneham and beyond, and also the Fellsway boulevard, controlled by the commission.

As soon as the Wellington bridge is under way, work will begin on the new bridge over the Saugus River between Revere and Lynn, which is to accommodate the "Lynnway" boulevard of the park system. The plans for this are now being prepared.

The bids for building two masonry abutments for the new bridge between Boston and Cambridge opened July 17, were as follows: Lawler Bros., $176,316; Jones & Meehan, $174,800; Patrick McGovern, $170,250; Holbrook, Cabot & Rollins, $168,000. The contract was awarded to the last named. The pile and concrete foundations are each 170 ft. long by 61½ ft. wide. There will be about 15,000 cu. yds. of concrete, 1,000 cu. yds. of granite, and 4,200 piles. The abutments must be completed on or before Aug. 1, 1903.

Bound Brook, N. J.—The Central R. R. of New Jersey contemplates abolishing four grade crossings by building two subways. A new station will also be built.

Brookfield, Mo.—The County Court has ordered the Bridge Commissioner to let contracts for three bridges.

Cambridge City, Ind.—The Richmond Street & Interurban Railway will build its own bridge over the creek in this city.

Carrollton, Mo.—Bids are wanted Aug. 5 for building several bridges in the county, some of which are steel. Silas Ballard, Commissioner.

Cathlamet, Wash.—Sealed proposals will be received by the Board of County Commissioners at this place until 2 p. m., Aug. 4, for a drawbridge across Algier's Slough, in accordance with plans on file with Jesse Baker, Clerk of the Board.

Chateauguay, Que.—A bridge to cost about $13,000 will be built at Allen's Corners.

Cincinnati, Ohio.—The City Engineer is making plans for a viaduct over Delta avenue to connect with Grandin road near West Crescent avenue.

Cleveland, Ohio.—Bids will probably be wanted, by the County Commissioners of Franklin County, about the first of next month, for the two bridges on Cleveland avenue, which are as follows:

Over Norfolk & Western and Cleveland, Akron & Columbus tracks.—A single span, through, plate-girder bridge, 71 ft. 5 in. out to out of end stiffeners, width 52 ft., center to center girders, with a central girder, with double track street railroad line, one track on each side of middle girder and a 6-ft. sidewalk on each side of bridge next to the outside girders.

Bridge over Pittsburgh, Cincinnati, Chicago & St. Louis and Baltimore & Ohio tracks.—A single span, through, low truss bridge consisting of three trusses which line up centers with last bridge; length of trusses, 106 ft. 8½ in., center to center end bearings; trusses all riveted, width 52 ft. 5 in., center to center outside trusses. Arrangement of street car tracks and sidewalks same as on last. Floor in both cases consists of concrete arches set between I-beam floor beams; entire under side of bridge covered with cement plaster held in place on expanded metal or wire netting. Floor surface on roadways and between street car tracks, block pavement; sidewalk top finish, cement floor. Outside faces of girders and trusses covered with cement plaster on ex. metal as bottom sides; space between upper and lower chords on truss bridge, on outside trusses, filled in with 2-in. tile construction which in turn is covered on outside with cement plaster; the idea being that absolutely no portion on the bottom or sides of bridges shows any steel surface for the smoke to work on.—Henry Maetzel, County Surveyor.

Concordia Parish, La.—E. F. Alsbury & Son, of Houston, Texas, have been awarded the contract for three steel bridges in Concordia Parish.

Cross Keyes, Pa.—M. D. Bowman, of Mahony City, it is said, will make the plans for the bridge over the Schuylkill River at this place, which is to be rebuilt by the State. It is possible that this contract will be let soon.

Dayton, Ohio.—H. E. Talbott & Co., of Dayton, was the lowest bidder on the new Main street bridge. It offers to build a plate girder bridge for $130,435, or a concrete steel bridge for $128,170.

Des Moines, Iowa.—The damage done to the Chicago Great Western bridge by high water is estimated at $25,000. Other bridges damaged are: Sixth avenue, $4,000; Second street, $15,000; East Sixth street, $3,500.

Drummond, Mich.—The township of Drummond will build a bridge over Pottaganissing River.

Delphi, Ind.—James C. Smock, County Auditor, is receiving separate bids until Aug. 5 and Aug. 6 for two culverts.

East Pittsburgh, Pa.—The Westinghouse Electric & Mfg. Co. will build a viaduct from Cable avenue to Oak Hill.

Falls City, Tenn.—Two bridges are authorized by the Warren County Court, one at Hennessey's Ford and one at Falls City.

Flint, Mich.—There is talk of building a $20,000 bridge at Saginaw street.

Glenwood, Pa.—The Baltimore & Ohio, it is said, will soon let contracts for rebuilding its bridge over the Monongahela at a cost of about $200,000.

Grand Forks, Minn.—It is said that a bridge is proposed over Red Lake River to East Grand Forks.

Green Bay, Wis.—Contracts for three steel or stone bridges in the towns of Lawrence, Rockland and Holland will be let July 29 by the county. The bids received exceed the estimates.

Harrisburg, Pa.—The Dauphin County Court has received the report of the viewers on the rebuilding of the bridge spanning the Juniata River at Millerstown, which was destroyed by fire June 10. The report recommends a new bridge to cost $92,000. If no objections are filed to the report within the next 30 days the court will likely approve it, and the matter will then go before the Board of Public Grounds and Buildings for the awarding of a contract.

The report of viewers recommending a new bridge over Manada Creek in East Hanover Township, Dauphin County, has been approved.

The Harrisburg Bridge Co. has invited bids for the purchase and removal by Oct. 1, 1902, of the material in the present flood-damaged wooden bridge over the Susquehanna River at Market street. There are 10 spans, each from 212 to 256 ft. long, containing over 1,500,000 ft. of white pine timber, also a large quantity of iron. After the removal of the old bridge the erection of the steel bridge will be begun. The capital stock has recently been increased and the contract for the new structure is about to be let.

The Pennsylvania Railroad purposes beginning the construction of the Herr street subway at an early date.

Kenosha, Wis.—It is said that the City Engineer is making plans for a steel bridge over the West Middle street crossing of Pike River.

Knoxville, Tenn.—The County Court of Grainger County, Tennessee, has decided to build a large bridge over the Holston River. It will cost $80,000, and the contract will be awarded the middle of next month.

Lewiston, Idaho.—It is said that a railroad bridge will be built over Cumberland River, and that the surveys are now being made.

Luray, Va.—A bridge of about 100 ft. span will be built in this city. T. R. Campbell, Mayor.

Middletown, Pa.—Town Council has agreed to the following proposition of the Pennsylvania Railroad looking to the abolition of the grade crossings at Union and Wood streets: Subways at Union and Wood streets, and a foot passageway at Catherine street; $20,000 toward paying property damages and a new passenger station near Union street; the railroad to take care of the canal bridges.

Mishawaka, Ind.—A bridge of three or five spans, steel or concrete-steel, will be built over St. Joseph River here. Alonzo J. Hammond, South Bend, Engineer. J. M. Brown, of South Bend, will receive the bids after the plans are made.

Montpelier, Vt.—The Central Vermont bridge over the Winooski River at Montpelier will be renewed by two riveted lattice bridges 149 ft. and 166 ft. long respectively, which have been released from its main line.

New York, N. Y.—Bridge Commissioner Lindenthal has put in his long-expected requisition for additional money to carry on work on bridges Nos. 3 and 4 over the East River. His estimates are as follows: Bridge No. 3, suspension.—Manhattan tower foundation, $507,000; Manhattan anchorage, $654,000; Brooklyn anchorage, $654,000; real estate required for Manhattan anchorage, $503,800; real estate required for Brooklyn anchorage, $257,600; engineering and contingencies, $266,080.

For the Blackwell's Island Bridge more money is needed, as the work is further along. The three sections into which Mr. Lindenthal has divided it are: The island span and two adjacent cantilevers, steel construction, complete, $1,700,000; engineering and contingencies, $100,000. The eastern anchorage and adjoining cantilever, steel complete, $800,000; engineering and contingencies, $80,000. The western anchorage and adjoining cantilever, steel complete, $1,000,000; engineering and contingencies, $100,000.

Painesville, Ohio.—It is said that the County Commissioners have decided to build the proposed bridge over Chagrin River at Willoughby Township, at a cost of about $30,000. John E. Post, Commissioner.

Perryville, Ark.—Bids are wanted until Aug. 20 by A. F. Leegh, County Judge, for a steel bridge 280 ft. long over Fourche River.

Pittsfield, Mass.—The Board of Public Works will have the bridge over the railroad tracks in Dalton built this year. The plans are with the State Railroad Commissioners and after being approved by this body the local board will advertise for bids.

Port Perry, Pa.—The Pennsylvania proposes to make extensive improvements between Pittsburgh and Pitcairn, which include a double track bridge at Port Perry, to cost probably $100,000.

Pueblo, Colo.—Wm. Peach, City Engineer, is making plans for improving the North avenue viaduct, for which $9,000 is appropriated.

Renfrew, Ont.—The bids for the Eganville bridge have been found to be too high. The engineer has been asked to modify the specification and call new bids.

River Edge, N. J.—Bids are wanted 3 p.m., July 28, at the office of A. Z. Bogert, this place, for a bridge.

Rome, N. Y.—Bids are wanted by the State Superintendent of Public Works, Albany, until noon July 30 for building a bridge over the Erie Canal at South James street, Rome.

San Jose, Cal.—The Supervisors have instructed County Surveyor MacMillan to prepare plans for a steel bridge to be erected over the Caranedero Creek, at an estimated cost of $4,000.

Somers, Conn.—The town has voted to build a steel bridge over Scantic River. It will be 65 ft. long and 25 ft. wide.

Spring Valley, Ill.—The Illinois Valley Traction Co. will build a steel bridge over a ravine near Spring Valley. Address W. H. Hawthorne, this place.

Temecula, Cal.—Plans and specifications will be ready July 25 for the county bridge at this place, which will be 100 ft. long and 18 ft. wide.

Toronto, Ont.—The Glen road bridge at Rosedale, a suburb of Toronto, is to be rebuilt by the York Township under the local improvement act. It is a long structure and was condemned last year. W. A. Clarke is the Township Clerk, Post Office Eglington, Ont.

Robert J. Fleming gives notice of the building of bridges over the Grand Trunk and Canadian Pacific tracks on Dundas street, between St. Helens avenue and Sorauren avenue, in the City of Toronto, at a cost of $140,072, under the local improvement act. C. H. Rust is City Engineer.

Other Structures.

Atlanta, Ga.—The Atlanta Wheel Co. has been organized by interests of the St. Louis Car Wheel Co. and will build a plant in Atlanta at a cost of about $75,000. The main building of this new plant is to be about 118 x 230 ft. John W. Nute, Secretary of the St. Louis Co., will be General Manager. P. B. Williams has opened office in the Empire Building, Atlanta, as local representative. The plans are now being made under the direction of P. A. Curran as Superintendent of Construction.

Beaver Falls, Pa.—The Penn Bridge Co. contemplates largely increasing its capital and doubling the capacity of its works in Beaver.

Birmingham, Ala.—The Birmingham Railway, Light & Power Company has let the contract for its new car barn and machine shop to T. C. Thompson & Son. The buildings will be 140 x 400 ft. each and will be of brick, stone and iron. The total outlay will be $150,000.

Bridgeport, Conn.—The Pequonnock Foundry Co. will build a foundry in Bridgeport. The officers are: President, Tracy B. Warren; Secretary, Percy P. Anderson; Treasurer, Arno R. Heuttig.

Canonsburg, Pa.—The Fort Pitt Bridge Works, of Pittsburgh, has begun work on enlarging its plant at Canonsburg, which will about double the capacity.

Clarksburg, W. Va.—According to reports from this place negotiations have been closed for a steel plant, a glass factory and a locomotive works. The company which will erect the locomotive works will be known as the Standard Motive Power Co. The plant will cover 35 acres of ground and be ready by next April. The steel mill will cost between $350,000 and $400,000. It will furnish employment to 600 men and will be ready for operation by April 1. The glass factory will be built and operated by the Brooks Glass Co., of New York. The cost of the factory will be $75,000, and it will employ 125 men. This factory will be ready for operation by Oct. 1, 1903. The three projects are said to be promoted by T. G. Brady.

Clearfield, Pa.—The Clearfield Steel & Iron Company has been formed by Charles and H. L. W. Hyde, and contracts for the puddling furnaces and rail re-rolling mills have been let to the Fort Pitt Bridge Co. The plant will be located at Clearfield and the company expects to begin operations within three or four months. It has already made arrangements for an independent coal supply. It is proposed to build 24 puddling furnaces with a capacity of 50 tons of iron and sufficient scrap will be re-rolled to make the daily tonnage 100 tons. It is also the intention to re-roll rails into lighter sections, the capacity for this work being about 50 tons a day.

Duluth, Minn.—The Northern Pacific is now expending $1,000,000 for shops, dock and terminals at Duluth. The work at that point which is now under way consists in the rearrangement of yard, building a 36-stall roundhouse, car shops and a few auxiliary buildings.

Fremont, Neb.—A union passenger station for the Elkhorn and Union Pacific roads has been authorized by the City Council.

Kokomo, Ind.—The new plant of the Kokomo Steel Company was started July 15. The buildings cover 15 acres of land given by the city. The works cost $1,000,000. The company was organized a year ago, with a capital of $2,000,000. A. A. Charles is President.

Lexington, Ky.—The Chesapeake & Ohio is preparing to rebuild the machine shops here and enlarge the railroad yards. The plans and specifications have already been drawn and bids will be asked.

London, Ont.—The McClary Manufacturing Co., of London, makers of all kinds of granite ware as well as stoves, ranges, furnaces, etc., will build a foundry in Canada, for which tenders will be called as soon as the plans are prepared.

Los Angeles, Cal.—President John B. Miller, of the Edison Electric Co., has confirmed the sale by that corporation of $10,000,000 in bonds, the proceeds to be used in completing a large electrical power and lighting system. Of the total bond issue, $3,000,000 will be available at once and the remaining $7,000,000 within the next five years, the engineer's estimates showing that that period will be required to complete the system. The engineers have been at work on the system for more than a year and plans are practically completed, and actual work will soon be begun.

MCKEESPORT, PA.—The United States Steel Corporation is said to have accepted the offer of this city to build its $10,000,000 tube mill here.

MEMPHIS, TENN.—The Illinois Central is preparing to begin work on the new shops in Memphis, which are to be the largest of the system.

MORGANTOWN, W. VA.—The Morgantown Electric & Traction Co. has engaged Walter Loring Webb, Consulting Engineer, of Philadelphia, to design a power plant, locate several miles of electric road and design the enlargement and reconstruction of the system of incandescent lighting. Plans will be ready within two months when bids will be called for.

OTTAWA, ONT.—E. J. Chamberlain, General Manager of the Canada Atlantic, is reported as saying that the company will begin work on the new central station for Ottawa this year. It is to cost about $250,000, and will accommodate all the roads entering the city.

PORTSMOUTH, VA.—The Norfolk & Western is buying land at Portsmouth with a view of building a yard and also some shops. The details are not decided upon.

ST. LOUIS, MO.—The Board of Managers in charge of the U. S. Government exhibit at the Louisiana Purchase Exposition to be held at St. Louis, has approved the plans for the Government building which have been prepared under the supervision of Mr. James K. Taylor, Supervising Architect of the Treasury. The building is to be 750 ft. long, 82 ft. high and 243 ft. wide at the ends, the center being 175 ft. wide, with a dome 100 ft. in diameter. The building will occupy a prominent position and will be built of white staff and cost about $350,000. Bids will be asked for in the near future.

TRENTON, N. J.—Fire on July 20 destroyed the central portion of the John A. Roeblings Sons' rolling mills, involving loss roughly estimated at $100,000. The braiding department, the tempering shop and the galvanizing shop were destroyed and a portion of the insulated wire department also was burned.

WEST MILWAUKEE, WIS.—The Chicago, Milwaukee & St. Paul has made an appropriation for enlargement of its shops at West Milwaukee, but as yet the plans are not fully decided upon.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

Roadmasters' and Maintenance of Way Association.

J. Alexander Brown, Secretary and Treasurer of the Road and Track Supply Association, announces that the 20th annual convention of the Road Masters' and Maintenance of Way Association will be held in Milwaukee, September 9, 10 and 11. The headquarters will be the Plankinton House. Arrangements have been made for an exhibition, and there will be ample room for models and devices that are not cumbersome.

PERSONAL.

—Mr. Stanton Ennes, Chief Train Despatcher of the Missouri Pacific, has been appointed Division Superintendent at Nevada, Mo. Mr. Ennes was born in 1862, at St. Louis, Mo., and entered railroad service in 1881 as a telegraph operator on the Texas Pacific. For one year, 1882 to 1883, he was telegraph operator and brakeman on the Southern Pacific, and in 1884 went to the Missouri Pacific as a telegraph operator. He was made Train Despatcher in 1886, and was Chief Train Despatcher from 1893 to July 1, this year, when his appointment as Division Superintendent took effect.

—Mr. M. Sheehan, the new Assistant Superintendent of the Kansas City, Memphis & Birmingham, was born Jan. 20, 1860, at Mallow, Ireland. His first railroad service was in 1876, when he began as an office boy on the Chicago & Alton. From 1880 to 1882 he was with the Chicago, Pekin & Southwestern as freight conductor. In 1882 he returned to the Chicago & Alton, holding a similar position, and later became Trainmaster. Mr. Sheehan resigned from the service of this company in 1900 to enter the service of the Kansas City, Memphis & Birmingham as Assistant Trainmaster, from which position he has recently been promoted to that of Assistant Superintendent.

—Press despatches from Texas say that Chairman John H. Reagan, of the Railroad Commission, has retired from that office, having been compelled by advancing years to give up his work. Judge Reagan is now 84 years old and is a unique figure in public life, having been a member of the cabinet of Jefferson Davis, of which body he is the sole surviving member. He was a delegate to the first Democratic State convention in Texas more than 50 years ago. After the war he was United States Senator and was a prominent figure in the discussions in Congress which led to the enactment of the Interstate Commerce Law in 1887. His Chairmanship of the Texas Commission dates, we believe, from the establishment of the Commission.

—Mr. W. G. Menzel, who has succeeded Mr. Cleaver as Superintendent of Motive Power and Cars of the Wisconsin Central, has returned to this company after an absence of several years. Mr. Menzel is a little past 40 years of age. He was born at Oneida, N. Y., and he entered railroad service in 1875 as an apprentice on the Chicago & North Western, later serving as a machinist. During the summer of 1882 he was employed by the Chicago, Milwaukee & St. Paul in the West Milwaukee shops, and in August of that year entered the service of the Wisconsin Central as a machinist. In 1887 he became foreman at Ashland, but was transferred to Stevens Point in 1889 and the next year went to Waukesha, taking a similar position. In January, 1889, he went to the Brooks Locomotive Company at Dunkirk, N. Y., and in July, 1901, was made traveling representative, which position he recently resigned to take his new position on the Wisconsin Central as above.

—Mr. Henry F. Campbell, who has been appointed Secretary for the Arbitration Committee of the American Railway Association, is a practical car service man, his service for the last 15 years being in that branch of work in the employ of the Pennsylvania Railroad Company. Mr. Campbell was born in Hackensack, N. J., in 1863, and entered the employ of the Pennsylvania in 1883 as a clerk in the Car Record Office at Philadelphia. Passing through the various grades he was in 1887 assigned to duties in connection with car service settlements and statistical information, and succeeded to the charge of the work in 1893 as Foreman of the Freight Car Mileage Department, in which position he remained until April, 1902. At that time he was promoted and assigned to special duty in the Transportation Department and held this latter position at the time of his appointment as Secretary for the Arbitration Committee. His office is 710 Continental Trust Building, Baltimore, Md.

—Mr. James P. Nelson, the new Chief Engineer of the Richmond, Fredericksburg & Potomac, is a native of Virginia, having been born in Staunton in 1849. Mr. Nelson was graduated from Washington and Lee University of Virginia in 1869 with the degrees of Civil and Mining Engineer. In the same year he was made Assistant and Resident Engineer of the western extension of the Chesapeake & Ohio. This position he held until 1873, and was from then until 1880 engaged in teaching. In 1880 he again took service with the Chesapeake & Ohio as Assistant and Division Engineer on construction of the Western and Peninsular Division. In 1883 he was Assistant Engineer constructing coal-storage pockets at Perth Amboy, N. J., and was for three years following Superintendent of the Danville & New River. In 1886 he returned to the Chesapeake & Ohio and remained with this company until 1889, when he was appointed Chief Engineer of the Western Division of the Newport News & Mississippi Valley. For six years following Mr. Nelson was professor of civil engineering at the State College of Kentucky. For one year, 1898 to 1899, he served the Choctaw & Memphis as bridge and office engineer. He resigned from this position in 1899 to again take service with the Chesapeake & Ohio, and has remained with this company up to his present appointment as Chief Engineer of the Richmond, Fredericksburg & Potomac, which took effect on July 15, last.

—Mr. George W. Beach, the veteran Superintendent of the Naugatuck Railroad, is to retire from his office at the end of this month, having served the road continuously for 52 years. By "Naugatuck Railroad" we mean, of course, the Naugatuck Division of the New York, New Haven & Hartford, though it must seem much more natural to Mr. Beach, as well as to thousands of his neighbors, to use the old name. It is understood that this division will be consolidated with the Berkshire, and Mr. Hopson placed in charge of the consolidated division. Mr. Beach began his railroad service at Humphreysville, while a boy, carrying the mails, at 25 cents a day. He began regular service as a clerk in 1850, and in 1851 went to Waterbury. While there the emergencies due to a flood led to his appointment as conductor of a gravel train, and from this time on he was an all-around railroader, serving as conductor, relief station agent and general ticket agent. In 1857 he was both general ticket agent and conductor, and about this time designed a lamp for lighting the passenger cars of his train with kerosene oil. Mr. Beach was agent at Waterbury from 1861 to 1868, and in the latter year was appointed Superintendent, which place he has held until now. During all of Mr. Beach's service as conductor he never had a butting collision; and had no collision on his division until he had been superintendent for 25 years. Mr. Beach may be called a pioneer "industrial agent" such as the roads in the West now employ to promote the establishment of new industries along their line; for while he was in charge of the Naugatuck road, and when Connecticut was not so thickly settled as now, he made it one of his first duties to keep an eye out for prospectors looking for factory sites and to do his best to get them to locate in the Naugatuck Valley. Many of his old-time vouchers for expenses include, no doubt, numerous modest sums expended in "steering" these capitalists. Mr. Beach has been a constant supporter and promoter of the Young Men's Christian Association, and especially in the railroad branch. For several years he was President of the American Society of Railroad Superintendents.

ELECTIONS AND APPOINTMENTS.

Atlantic Coast Line.—The following appointments have been made: George S. LeGrand Auditor of Passenger Receipts, R. S. McIver Auditor of Freight Receipts, Spencer LeGrand Auditor of Freight Receipts, H. H. McKee Auditor of Disbursements, and R. A. Williams Assistant Auditor of Disbursements, all with headquarters at Wilmington, N. C.

Augusta Southern.—C. H. Ackert has been appointed General Manager, succeeding F. S. Gannon, resigned.

Blackwell, Enid & Southwestern.—W. W. Irwin has been appointed Auditor and Traffic Manager, with headquarters at Vernon, Texas, succeeding H. C. Brown, resigned. The position of General Superintendent has been abolished and the duties of that office have been assumed by the General Manager.

Brockville, Westport & Sault Ste. Marie.—W. H. Cole has been elected Vice-President.

Central New England.—C. H. Ewing, Chief Engineer, with headquarters at Hartford, Conn., has resigned. (See Philadelphia & Reading.)

Central of Georgia.—W. E. Estes, heretofore Assistant General Freight Agent, has been appointed General Freight Agent. J. L. Graham succeeds Mr. Estes.

Chesapeake & Ohio.—G. W. Hepburn, heretofore Assistant Master Mechanic, has been appointed Master Mechanic, with headquarters at Covington, Ky. W. R. Morris, heretofore Assistant Master Mechanic at Lexington, succeeds Mr. Hepburn.

Colonisation du Nord.—The officers of this company are: President, J. D. Rolla; Vice-President, D. McNicoll; Secretary, H. C. Oswald, and Treasurer, A. E. Suckling. (See R. R. Construction column.)

Denver, Enid & Gulf.—The officers of this company are: Breckenridge Jones, President; Henry Semple Ames, Secretary and Treasurer; Ed L. Peckham, Vice-President; G. J. Blanchard, Assistant Secretary; A. G. C. Bierer, General Solicitor, and F. G. Jonah, Chief Engineer. (See R. R. Construction column, June 20, p. 485.)

Denver, Northwestern & Pacific.—The officers of this company are: President, David H. Moffat; Vice-President, W. G. Evans; Treasurer, George E. Ross-Lewin, and Secretary, F. B. Gibson.

Des Moines, Iowa Falls & Northern.—P. A. Mitchell has been appointed Superintendent of Construction. Thomas L. Longley has been appointed Superintendent, with headquarters at Iowa Falls, Iowa.

East & West.—J. W. Bushnell has been appointed Chief Engineer, with headquarters at Cedartown, Ga.

L. B. Parsons, Acting General Roadmaster of the Seaboard Air Line, has been appointed Superintendent of the E. & W., with headquarters at Cedartown, Ga.

Eastern of Minnesota.—See Great Northern.

Grand Trunk.—George W. Bartlett has been appointed Resident Engineer, with headquarters at Detroit, Mich., succeeding C. J. Crowley, resigned.

Great Northern.—This company having leased the lines of the Eastern Railway of Minnesota, the office of Chief Engineer of the E. of M. has been abolished. J. D. Mason, heretofore Chief Engineer of the E. of M., has been appointed Resident Engineer of the Eastern Division of the G. N., with headquarters at West Superior, Wis.

Gulf & Ship Island.—W. W. Vail has been appointed Chief Engineer, with headquarters at Gulfport, Miss., succeeding L. A. Washington.

Iowa Central.—The headquarters of J. N. Tittemore, Traffic Manager, have been removed from Marshalltown, Iowa, to Peoria, Ill.

Kansas City Southern.—The office of Freight Traffic Manager has been abolished.

New York, Chicago & St. Louis.—R. E. Payne has been appointed General Agent of the Passenger Department, with headquarters at Buffalo, N. Y., succeeding F. J. Moore, resigned.

New York, New Haven & Hartford.—George W. Beach, Superintendent of the Naugatuck Division, with headquarters at Waterbury, Conn., has resigned.

Philadelphia & Reading.—C. H. Ewing, heretofore Chief Engineer of the Central New England, has been appointed Division Engineer of the P. & R., with headquarters at Reading, Pa.

Pittsburgh Coal Company.—F. H. Stark has been appointed Superintendent of Rolling Stock, succeeding J. E. Simons, resigned.

Queen & Crescent.—G. W. Berry has been appointed Acting Superintendent of the Chattanooga Division.

St. Louis & San Francisco.—The position of Superintendent of Maintenance, formerly held by R. R. Hammond, will, on Aug. 1, be abolished.

Wiscasset, Waterville & Farmington.—G. P. Farley has been elected Vice-President, succeeding F. C. Thayer, resigned. J. H. Gould has been appointed Treasurer.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ACME, RED RIVER & NORTHERN.—This company has been chartered in Texas to build from Acme on the line of the Fort Worth & Denver City north to the Red River, about 8 miles. E. H. East, T. La Hache and others, of Sherman, Texas, and elsewhere, are interested.

ALPENA, GAYLORD & WESTERN.—Contract is said to have been let for 40 miles of this proposed railroad in Michigan, which is to run through Alpena, Montmorency and Otsego Counties. Work is to be begun at a point 16 miles east of Gaylord and will run west to Mancelona.

ARKANSAS & LOUISIANA.—In regard to the recent amendment to the company's charter, providing for a 25 mile extension from the present terminus at Hope, Ark., to Stamps, an officer writes that the line will not be built at present. (July 18, p. 579.)

ATCHISON, TOPEKA & SANTA FE.—Work is reported completed on the Eastern Oklahoma Branch of the Oklahoma Division, from Pawnee, Okla. T., eastward to Ralston, 18 miles. A new branch on the division has also been opened from Ripley to Cushing, 11 miles. (May 16, p. 372.)

AUGUSTA & OAKLAND (ELECTRIC.)—This company has filed articles of association in Maine for an electric road from Augusta to Belgrade Lake and Oakland, a distance of 19 miles. (See Augusta & Waterville below.)

AUGUSTA & WATERVILLE (ELECTRIC).—This company has been organized in Maine and has filed articles of association for an electric road from Augusta to Waterville by way of Winslow, a distance of about 20 miles, through a country not now reached by any railroad.

BALTIMORE & OHIO.—An officer sends the following information about the new low-grade freight line from Cherry Run, W. Va., to Wilson's, W. Va., for which contract was let last spring to F. H. Clement & Co., of Philadelphia. The line is now building and will be nine miles long. About 50,000 cu. yds. of excavation have been completed and there are about 500 men at work. The work is chiefly rock excavation. The maximum grades will be 3 per cent. compensated; the maximum curves 4 deg. The work includes one iron bridge 270 ft. long but no tunnels. (May 16, p. 372.)

BOONE MOUNTAIN.—An officer writes that location is in progress for this projected line chartered July 10, to build from a point near Weedville to Hellen Mills, on the Toby Branch of the Erie, in Elk County, Pa., 13 miles. The character of the work to be done is difficult. No contracts have as yet been let. H. H. North, of Bradford, Pa., is President, and L. B. Dill is Chief Engineer. (July 18, p. 579.)

CAROLINA COLONY.—This company has been chartered in North Carolina to build from Concord, N. C., to Fayetteville, through the Counties of Cabanus, Montgomery, Stanley, Moore and Cumberland, a distance of about 100 miles, air line.

CHESAPEAKE & OHIO.—Work is reported completed on an extension of the Greenbrier Division, from Cass, W. Va., to Durbin, 15 miles.

CHICAGO, MILWAUKEE & ST. PAUL.—An officer writes in regard to rumored extensions of the Eureka Line, that the present one upon which the company is now at work will end at Linton, N. Dak.

CHICAGO SOUTH SIDE ELEVATED.—The South Side Elevated road of Chicago is considering a plan for extending its line to the lake shore along Fortieth street and also to the Union Stock Yards in the opposite direction. The line of the Union Stock Yards & Transit Co., leased by the Chicago Junction, runs from the Illinois Central tracks west on Fortieth street to the stock yards. This track must be elevated and while there appear to be no definite plans at present, it seems probable that the two companies will form some arrangement whereby the elevation of the Transit Co.'s tracks and the building of a structure for the Elevated Co. will be done at the same time; this would require some kind of a double-deck structure. At present the Transit Co.'s line, besides serving as a means of communication between the Illinois Central and the stock yards, is also used by the Lake Shore & Michigan Southern for suburban trains which are run as far as Lake street. It would seem that if the South Side Elevated is extended to Lake street it would have an excellent opportunity to parallel the tracks of the Illinois Central as far south as Sixty-third street, where the elevated road terminates at present. By running express trains over this portion of its line it could

come into very active competition with the Illinois Central's suburban service.

COAHUILA & PACIFIC.—This line between the points named in Mexico, 192 miles distant, which has been building for two years or more, is now reported completed, regular passenger train service having been inaugurated on July 10. The company laid 110 miles of track, exclusive of second track and sidings, last year.

COLONISATION DU NORD.—This company was organized at Montreal July 10, and it is said that contracts for a line from Labelle, Que., to Nominingue, Que., 25 miles, will be let at once. The company's charter permits also of extension to Rapide de l'Original, 30 miles further. Hon. J. D. Rolland, of Montreal, was elected President, and D. McNicoll, Vice-President.

COLUMBIA SOUTHERN.—It is said that contracts for grading the first 30 miles of the projected extension from Shaniko to Crooked Bend, Ore., will be let by August 1. Location is now in progress, and preliminary surveys were reported completed last spring. The incorporation provides for a line to Bend, Ore., 100 miles from Shaniko. A. E. Hammond, Portland, Ore., is Chief Engineer. (April 11, p. 277.)

CUMBERLAND (KENTUCKY).—This company filed articles of incorporation at Frankfort, Ky., July 15, to build from a point on the Cumberland Valley Division of the Louisville & Nashville, near Artemus, Knox County, to Lunsford, in the same county, 10 miles distant, by way of Big Brush Creek, and crossing Cumberland River. L. R. Freeman, of Warren, Pa., is interested.

DELAWARE & HUDSON.—Work is reported completed on the Fort Edward-South Glens Falls branch, 4.8 miles, and building is also in progress on a spur about 1.5 miles long to the mills of the Union Bag & Paper Co., Baker's Falls, N. Y.

DELAWARE & NORTHAMPTON.—This company was chartered July 16 in Pennsylvania, to build a steam railroad from a point near Sandt's Eddy, Northampton County, to the Borough of Stockertown, in the same county, six miles. The capital stock is $60,000, and B. Sherwood Dunn, of Easton, Pa., is President.

DENVER & NORTHWESTERN.—Bids were said to have been opened July 10 for 18 miles of new track, on this projected line in Colorado. Samuel M. Perry, of Denver, Colo., is interested. (July 4, p. 543.)

DENVER, NORTHEASTERN & PACIFIC.—This projected line from Denver to Salt Lake City and San Francisco, which is projected by D. H. Moffat and others, filed articles of incorporation in Colorado, July 18, with capital of $20,000,000. (June 27, p. 520.)

EL PASO & SOUTHERN.—Charter for this company was filed at Austin, Texas, on July 11. The company has a capital of $2,000,000 and proposes to build a railroad from the boundary line of Texas and New Mexico, three-fourths of a mile above the boundary of Missouri, to the western limits of El Paso, three miles; also east through the city two miles further. The incorporators are James Douglas, Wm. E. Dodge, and others, of New York, and elsewhere.

FORT WAYNE, DAYTON & CINCINNATI (ELECTRIC.)—Surveys are now in progress for this projected electric line in Indiana and Ohio, and are practically completed between Celina and Fort Wayne, 45 miles. It is the intention of the company to begin grading this section of the line at once, and it is hoped that a portion, at least, will be in operation next winter. Cincinnati is about 100 miles beyond Celina, making the total distance in an air line, 145 miles. C. M. Smith, of Celina, may be addressed.

GALESBURG & GREAT EASTERN.—It is said that a line will be built from Victoria to Wyoming Creek, Ill., 21 miles. Work is in progress between Victoria and Walnut Creek, eight miles. The line is now in operation between Wataga and Victoria, 10 miles.

GREAT NORTHERN.—Contract is reported let to Grant, Smith & Co. to rebuild 14 miles of line between Elmira and Banner's Ferry, Idaho. The grade is to be reduced from 1 per cent. to .6 of one per cent., and a number of curves eliminated.

GREAT WESTERN (ELECTRIC).—Work is reported completed on this new electric freight line from Loveland to Berthoud, Col., 25 miles. An extension from Denver to Loveland, 50 miles, is also being built. The road was incorporated in Oct., 1901, in the interest of the Colorado Sugar Beet Co., and Charles Boettcher, of Denver, is president. (Nov. 1, 1901, p. 764.)

ILLINOIS CENTRAL.—An officer writes that no definite plans have been made with reference to the rumored line from Brookhaven to Monticello, Miss.

INTERVALE TRACTION.—This company was incorporated at Albany July 18, to build an electric road 28 miles long from Newburgh to Goshen, N. Y. The directors are Hiram A. Odell, J. A. P. Ramsdell and others, of Newburgh and elsewhere.

JASPER, FRENCH LICK, WEST BADEN & NORTHWESTERN TRACTION.—This company has been organized in Indiana to build an electric road from Jasper to West Baden, by way of French Lick, a distance of about 24 miles. Jasper, in DuBois County, is on the Southern, and West Baden is on the Chicago, Indianapolis & Louisville.

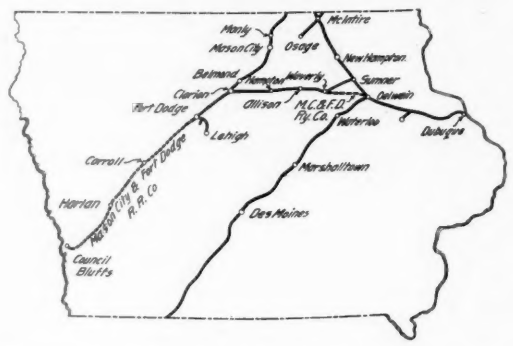
JONESBORO, NEWPORT & WESTERN.—Work is reported in progress on this new line between Jonesboro and Newport, Ark., about 40 miles, through a timber belt and a fertile valley between the White and Cache Rivers. E. L. Westbroom, Jonesboro, Ark., is General Manager. (March 21, p. 217.)

KANSAS CITY, DALLAS & OLATHE.—This company has been chartered in Missouri to build a railroad from Kansas City to Olathe, Kan., about 25 miles.

KENTUCKY ROADS.—It is said that a contract will be let soon for a railroad from Brush Creek on the Louisville & Nashville to coal properties in Jackson County, Ky.

LA CROSSE & EASTERN (ELECTRIC).—Surveys are reported for this new electric line in Wisconsin. It is proposed to build from La Crosse along the Mississippi River, southeast as far as Stoddard, striking across at that point to Chaseburg and Viroqua, a total of about 30 miles. (May 9, p. 354.)

MASON CITY & FORT DODGE (CHICAGO GREAT WESTERN.)—An officer writes that surveys are completed for this line and grading is well under way. Contracts for grading, track laying, bridges, etc., have already been let, and rails and rolling stock have already been bought. The line is about 28 miles long and saves eight miles between Chicago and Omaha. The accompanying map of Iowa shows the Chicago Great Western lines within the State, with this cut-off incorporated under the name of the Mason City & Fort Dodge Ry., and also the projected line from Fort Dodge to Council Bluffs, incorporated as



the Mason City & Fort Dodge R. R. Contracts for portions of the latter have been let to P. E. Strugart, McArthur Bros. and Winston Bros. (June 27, p. 520.)

MEXICAN NATIONAL.—It is said that an extension is projected from San Miguel and Camargo to Monterey, about 150 miles, and that surveys will begin some time this year.

MICHIGAN CENTRAL.—The extension of the Caro branch, from Caro, Mich., east to Owendale, 21 miles, has been completed.

MIDDLEFIELD-SHARON.—It is said that rights of way are being secured between Middlefield, Ohio, and Sharon, Pa., by way of Bloomfield, Greene, Gustavus and Kinsman, a total of about 38 miles. This line is built to be a link in the proposed line between Cleveland and Pittsburgh.

NEW YORK CENTRAL & HUDSON RIVER.—The West Branch Valley line from Karthaus to Clearfield, Pa., 30 miles, on the Pennsylvania Division, is practically completed. (See illustrated article, March 14.)

NEW YORK, ONTARIO & WESTERN.—Extension of the Ellenville Branch from Ellenville, N. Y., to Kerhonkson is reported completed. The distance is 7 miles.

NORTH CAROLINA ROADS.—It is said that a railroad about eight miles long, standard gage, will be built from Ayden to lumber lands owned by the Ayden Lumber Co.

OHIO RIVER COAL & RAILWAY.—This company filed articles of incorporation in Illinois July 7, to build from a point on the Ohio River near Roisclare, northwest through Hardin, Pope and Saline Counties to Marion in Williamson County, and from Harrisburg to Galatia, in Saline County, a total of about 55 miles. Galatia is on the Illinois Central. Harrisburg is on the Cleveland, Cincinnati, Chicago & St. Louis, and Marion is a junction of the Illinois Central and the Chicago & Eastern Illinois Railroads.

OHIO ROADS.—Surveys are reported at a point near Cortland, running up Mosquito Creek close to the proposed ship canal, from Pittsburgh to a point on Lake Erie. Names of interested parties are not stated.

OZARK & CHEROKEE CENTRAL.—Work is reported completed on an extension from Westville, Ark., to Proctor, 16 miles.

PENNSYLVANIA.—Double tracking is reported completed on the Philadelphia & Erie between Keating and McElhattan, Pa., 46 miles. This work was begun last year under an agreement with the New York Central & Hudson River to furnish an outlet for coal originating on the Beach Creek line. It is said the improvements have cost considerably over $1,000,000. (May 30, p. 404.)

It is said that work will be begun at once double-tracking the branch from Watt to Everson in Fayette County, Pa. The distance is 10 miles.

PENNSYLVANIA ROADS.—Two corps of surveyors are reported working in Fulton County, Pa. One line is being run from Shade Gap in Huntingdon County, by way of Burnt Cabins, towards McConellsburg, a distance of about 20 miles, and the other route starts at Brush Creek Valley and runs across the State line into Maryland. Shade Gap is on the line of the East Broad Top R. R., and it is thought that surveys are in the interest of this company.

RICE LAKE & NORTHERN.—It is said that an extension will be built from Birchwood to Reserve Village, Wis., 20 miles. The company was incorporated in March, 1901, to build about 100 miles of railroad in Wisconsin, from Rice Lake to Ashland, and completed 15 or 20 miles last year. G. M. Huss, Birchwood, Wis., is Vice-President and General Manager.

RICHLAND & MAHONING.—Work is reported begun on a new railroad in Ohio between Akron and Youngstown, 50 miles, in the interest of the Richland & Mahoning, which is projected from Mansfield, Ohio, east to Wooster. C. W. French, of Mansfield, Ohio, is interested.

SAGINAW SUBURBAN ELECTRIC.—Contracts are reported let for an electric line between Saginaw and Flint, Mich., a distance of about 30 miles, and it is said work will begin Aug. 1.

ST. LOUIS & GULF.—Articles of incorporation have been filed in Missouri for an extension from a point in or near Clarkton, through Malden to the northern line of the county, a distance of about 12 miles. It is said that an extension will also be built from Vanduser, Scott County, to a connection with the Bloomfield Branch of the St. Louis & Gulf at Zeta in Stoddard County, 10 miles. (April 25, p. 316.)

ST. LOUIS VALLEY.—This road, incorporated March 25, 1901, has completed 120 miles, between E. St. Louis and Gale, Ill., out of the 146 projected. The eventual terminus is to be Cairo. Work is in progress on a branch into Williamson County. Wm. E. Guy, St. Louis, is General Manager.

SOUTHERN PACIFIC.—An officer writes that beginning August 2 some of the steamers of the Morgan Line will run to Galveston instead of to New Orleans. This does not mean the abandoning of the New Orleans line, which will continue to be run about as heretofore, but some ships will run direct to Galveston, giving a regular service between New York and that point.

TOLUCA, MARQUETTE & NORTHERN.—Grading is in progress on an extension 10 miles long from Magnolia, on the main line, to Henry, Ill. The road was completed and put in operation last winter from Rutland, Ill., three miles beyond Price, a total of 21 miles. Chas. Henning, Toluca, Ill., is General Agent. (Jan. 31, p. 86.)

WEST VIRGINIA ROADS.—Contract is reported let to J. C. Carpenter & Co., of Macdonald, W. Va., for a railroad 12 miles long, to reach the properties of the McKell Coal Co., on Loup Creek, W. Va.

GENERAL RAILROAD NEWS.

HARRIMAN & NORTHEASTERN.—This road, 20 miles long, running from Harriman to the State coal mines at Petros, Tenn., has been sold by the Harriman Land Co. to President Bird Robinson, of the railroad. First mortgage bonds to the amount of $150,000 are due next December. Mr. Robinson assumes the obligations of the road and pays also $80,000 in cash.

INDIANAPOLIS NORTHERN TRACTION.—A mortgage for $5,000,000 to the Colonial Trust Co., of New York, trustee, has been filed, to secure 30-year 5 per cent. gold bonds. Of the total issue, $3,500,000 is to be applied to the main line between Indianapolis and Logansport, including the branch east to Elwood. The remaining $1,500,000 is for the completion of and acquisitions to the street railroads in Tipton, Kokomo, Carmel, etc., as needed. At the same time a lease was made by which all the properties belonging to the company are to be controlled for 50 years by the Union Traction Co. of Indiana. (See map in our issue of June 27, p. 520.)

LOUISIANA & ARKANSAS RAILWAY.—This company has been organized to extend the charter of the Louisiana & Arkansas Railroad. It has taken over the assets of the railroad and an issue of first mortgage gold 5s has been purchased by Fisk & Robinson, for the purpose of retiring the existing $600,000 6 per cent. bonds and for additions, betterments, etc. The company at present operates a line 125 miles long between Stamps, Ark., and Winnfield, La., and has several extensions in view. Bonds to the amount of $4,500,000 were authorized, of which it is proposed to issue $1,500,000 at the present time.

OAKLAND TRANSIT CONSOLIDATED.—E. H. Rollins & Sons offer $700,000 first consolidated sinking fund 5 per cent. 30-year bonds. No more bonds are to be issued at present out of the total $6,500,000 to which the mortgage is limited, $3,500,000 being held by the trustee against outstanding bonds of subsidiary companies, $1,090,000 reserved to build lines not yet located, $600,000 for double tracking and new power house equipment, and $610,000 for other specified additions and betterments. Restrictions are placed on the issuance of all the bonds reserved for betterments, etc., and in none of the above cases are they to exceed 80 per cent. of cost price of completed construction. The company now owns 134 miles of track, comprising practically all the street railroads in Oakland, Alameda, Berkeley and Alameda county.

OREGON & SOUTHEASTERN.—First mortgage, sinking fund, five per cent. gold bonds, due in 1922, have been offered by the Hergen Investment Co., of New York, to the extent of $300,000, with seven per cent. cumulative preferred stock as a bonus. The company was incorporated in New Jersey, last April, and is building a railroad 36 miles long from Cottage Grove, Ore., on the Southern Pacific, Lane County, to the Champion quartz mill and other points in the Bohemia mining district. George W. Crosby, Atlantic City, N. J., is President.

ST. LOUIS SOUTHWESTERN.—Consolidated mortgage 4s of 1902 were listed at the New York Stock Exchange, July 18, to the amount of $12,054,000, out of $25,000,000 total, and the listing of additional amounts was authorized, until Dec. 31, 1902, the total listed and to be listed not to exceed $15,000,000. Of this $15,000,000, $6,000,000 have been issued already to retire equipment trust obligations, and for betterments, etc., and $9,000,000 is for retiring second mortgage income bonds, the remainder of the total being reserved for additions, betterments, etc.

SIOUX CITY TRACTION.—This property is reported purchased by interests controlling the Sioux City stock yards. The Traction Company was chartered in 1895 to succeed the Sioux City Street Ry., sold in foreclosure, and in 1899 it absorbed all the other Sioux City lines and now owns 42 miles of road, including interurban lines. There is capital stock outstanding to the extent of $1,100,000, and $750,000 of 5 per cent. first mortgage gold bonds, maturing in 1919. The franchises extend for 50 years from 1889.

SUFFOLK & CAROLINA.—The underwriting of $500,000 bonds to provide for standard gaging and extension to Edenton and Elizabeth City, N. C., has been undertaken by the International Trust Co., J. W. Middendorf & Co., Baker, Watts & Co., and William C. Seddon & Co., of Baltimore. The road is now in operation between Suffolk and Mavaton, N. C., 41 miles, and the proposed extensions involve about 35 miles additional. Wm. H. Bosley, of Baltimore, is President, and Geo. L. Barton, of Suffolk, Va., is General Manager.

TERMINAL ASSOCIATION OF ST. LOUIS.—Arrangements are reported completed by which this company takes over the St. Louis Belt & Terminal, the Interstate Car Transfer and the Wiggins Ferry properties. The Terminal Association is at present composed of the Cleveland, Cincinnati, Chicago & St. Louis, Louisville & Nashville, Missouri Pacific, Wabash, Baltimore & Ohio Southwestern and St. Louis, Iron Mountain & Southern roads, and the St. Louis & San Francisco and the Chicago, Rock Island & Pacific, will, it is said, be admitted under the new agreement. The Wiggins Ferry Co., besides its floating equipment, owns freight yards and 12 miles of terminal tracks in St. Louis.

UNION PACIFIC.—Holders of preferred and common stock of record Aug. 1, 1902, are offered the privilege of subscribing at 90 and accrued interest for an amount equal to 15 per cent. of the par value of their stock of Oregon Short Line 4 per cent. and participating 25-year gold bonds. Besides the 4 per cent. interest, these bonds are entitled for each year beginning with 1903, to an amount equal to any dividends and interest which may be paid in cash during the year upon the deposited collateral, in cases of 4 per cent. upon the amount of the outstanding bonds. All or any of these bonds may be redeemed at the option of the Short Line at a premium of 2½ per cent., plus accrued interest and dividend payments on any interest day, upon at least three months published notice. Arrangements have been completed for the sale of so many of $31,000,000 of said bonds as are not subscribed for by the stockholders of the Union Pacific upon this offer.

UNION TRACTION CO. OF INDIANA.—Lease of Indianapolis Northern Traction: see the latter.